Service Manual Outline

Notice

Throughout this publication, "Dangers", "Warnings" and "Cautions" (accompanied by the International HAZARD Symbol ⚠) are used to alert the mechanic to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **OBSERVE THEM CAREFULLY!**

These "Safety Alerts" alone cannot eliminate the hazards that they signal. Strict compliance to these special instructions when performing the service, plus "Common Sense" operation, are major accident prevention measures.

⚠ DANGER
DANGER - Immediate hazards which WILL result in severe personal injury or death.

⚠ WARNING
WARNING - Hazards or unsafe practices which COULD result in severe personal injury or death.

⚠ CAUTION
Hazards or unsafe practices which could result in minor personal injury or product or property damage.

Notice to Users of This Manual

This service manual has been written and published by the Service Department of Mercury Marine to aid our dealers' mechanics and company service personnel when servicing the products described herein.

It is assumed that these personnel are familiar with the servicing procedures of these products, or like or similar products manufactured and marketed by Mercury Marine, that they have been trained in the recommended servicing procedures of these products which includes the use of mechanics' common hand tools and the special Mercury Marine or recommended tools from other suppliers.

We could not possibly know of and advise the service trade of all conceivable procedures by which a service might be performed and of the possible hazards and/or results of each method. We have not undertaken any such wide evaluation. Therefore, anyone who uses a service procedure and/or tool, which is not recommended by the manufacturer, first must completely satisfy himself that neither his nor the products safety will be endangered by the service procedure selected.

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. As required, revisions to this manual will be sent to all dealers contracted by us to sell and/or service these products.

It should be kept in mind, while working on the product, that the electrical system and ignition system are capable of violent and damaging short circuits or severe electrical shocks. When performing any work where electrical terminals could possibly be grounded or touched by the mechanic, the battery cables should be disconnected at the battery.

Any time the intake or exhaust openings are exposed during service they should be covered to protect against accidental entrance of foreign material which could enter the cylinders and cause extensive internal damage when the engine is started.

It is important to note, during any maintenance procedure replacement fasteners must have the same measurements and strength as those removed. Numbers on the heads of the metric bolts and on the surfaces of metric nuts indicate their strength. American bolts use radial lines for this purpose, while most American nuts do not have strength markings. Mismatched or incorrect fasteners can result in damage or malfunction, or possibly personal injury. Therefore, fasteners removed should be saved for reuse in the same locations whenever possible. Where the fasteners are not satisfactory for re-use, care should be taken to select a replacement that matches the original.

Cleanliness and Care of Outboard Motor

A marine power product is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten thousands of an inch/mm. When any product component is serviced, care and cleanliness are important. Throughout this manual, it should be understood that proper cleaning, and protection of machined surfaces and friction areas is a part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Whenever components are removed for service, they should be retained in order. At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.

Personnel should not work on or under an outboard which is suspended. Outboards should be attached to work stands, or lowered to ground as soon as possible.

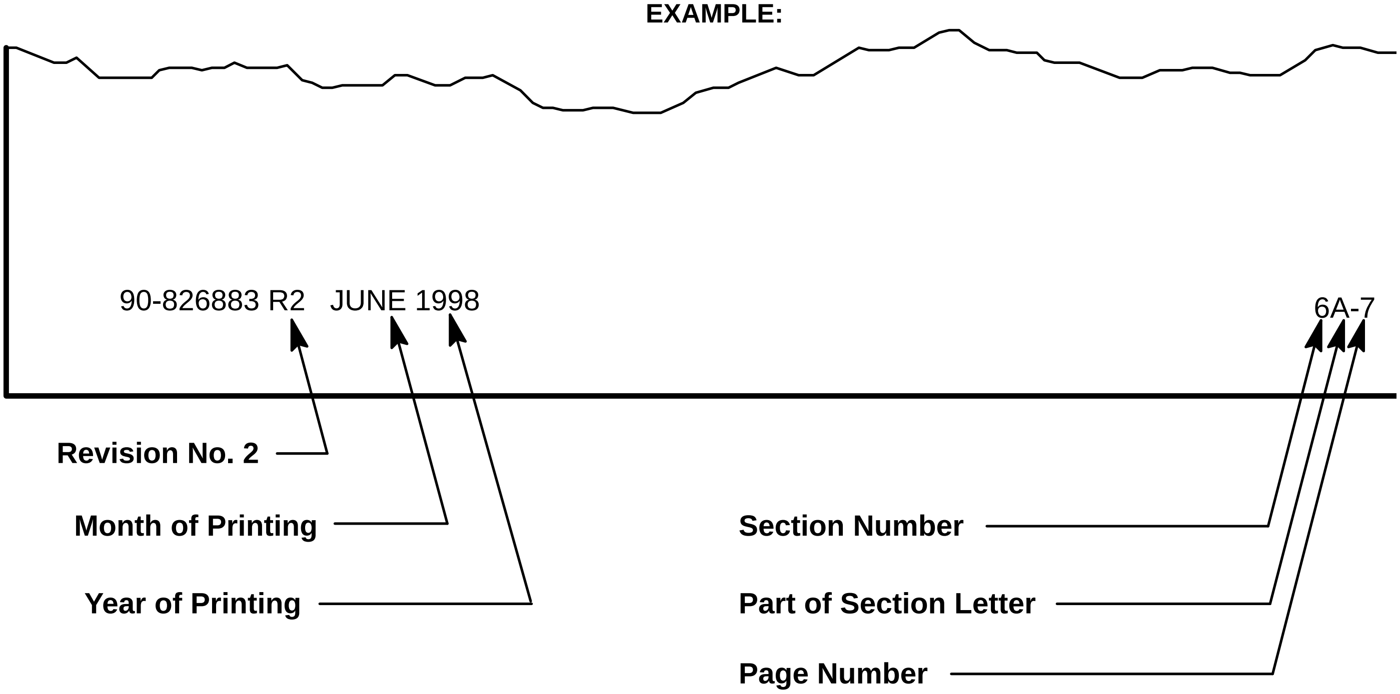
We reserve the right to make changes to this manual without prior notification.

Refer to dealer service bulletins for other pertinent information concerning the products described in this manual.

Page Numbering

Two number groups appear at the bottom of each page. The example below is self-explanatory.

EXAMPLE:

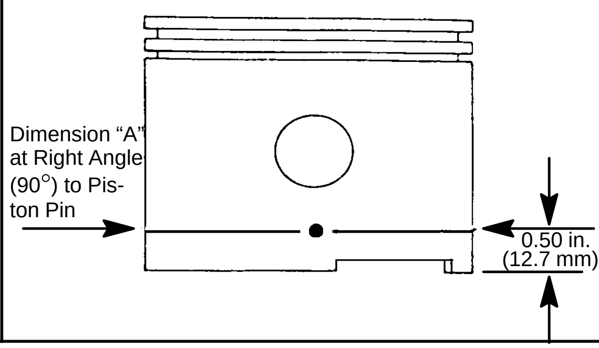


IMPORTANT INFORMATION

Section 1A - Specifications

Table of Contents

Master Specifications

Model 15XD/20 Jet /20/25		
HORSEPOWER (KW)	**Model 20 Jet** **Model 20** **Model 25**	20 (14.9) 20 (14.9 25 (18.7)
OUTBOARD WEIGHT	**15 in. (38 cm)** **20 in. (51 cm)** **20 Jet**	114 lbs - 52 kg 117 lbs - 53 kg 124 lbs - 56 kg
CYLINDER BLOCK	**Type** **Displacement**	Two Cylinder - Two Cycle 24.4 cu. in. (400 cc)
STROKE	**Length**	2.362 in. (60 mm)
CYLINDER BORE	**Diameter (Standard)** **Taper/Out of Round Maximum*** **Bore Type:** **S/N 0G202749 and Below** **S/N 0G202750 and Above**	2.562 in. (65.01 mm) 0.003 in. (0.08 mm)* Chrome Mercosil
CRANK SHAFT	**Top Main Bearing Journal** **Center Main Bearing Journal** **Bottom Main Bearing Journal** **Connecting Rod Journal** **End Play**	1.251 in. (31.77 mm) 1.000 in. (25.40 mm) 1.125 in. (28.58 mm) 0.883 in. (22.43 mm) 0.004-0.019 (0.10-0.64 mm)
CONNECTING ROD	**Piston Pin End (I.D.)** **Crankpin End (I.D.)**	0.897 in. (22.78 mm) 1.196 in. (30.38 mm)
PISTON	**Piston Type** **O.D. at Skirt (Standard)** **Ring End Gap**	Aluminum 2.5583 - 2.5593 (64.98 - 65.00) 0.011-0.025 (.28 mm - .64 mm)
PISTON DIA.		2.5583 in. ± .0005 in. (64.98 mm ± .0127 mm)**Using a micrometer, measure dimension “A” at location shown. Dimension “A” should be 2.5583 in. ± .0005 for a STANDARD size piston (new) Dimension “A” will be 0.001 – 0.0015 less if coating is worn off piston (used)**

***Models S/N 0G202749 and Below:**

NOTE: *The cylinder bores are chrome and cannot be be rebored or efficiently honed. Check each cylinder bore for an out-of-round “egg shaped” cylinder. A maximum of 0.003 in. (0076mm) is allowable.*

***Models S/N 0G202750 and Above:**

NOTE: *The cylinder block is Mercosil and the cylinders can be rebored to 0.030 in. oversized. Check each cylinder bore for an out-of-round “egg shaped” cylinder. A maximum of 0.003 in. (0.076mm) is allowed.*

Master Specifications

GEAR HOUSING	**Forward - Neutral - Reverse** **Gear Ratio** **Gearcase Capacity** **Lubricant Type** **Forward Gear - No. of Teeth-Type** **Pinion Gear - No. of Teeth-Type** **Pinion** **Foreword Gear Backlash** **Reverse Gear Backlash** **Water Pressure @ RPM** **Water Pressure With 120° Thermostat**	Full Shift 2.25:1 8.8 fl.oz. (260 ml) Quicksilver Gear Lube Premium Blend 27 12 Not Adjustable Not Adjustable Not Adjustable 2-7 PSI @ 2000 RPM 0-6 PSI (SPORADIC) 2000 RPM
MID SECTION	**Transom Height - Short Shaft** **- Long Shaft**	15 in. (38 cm) 20 in. (51 cm)
FUEL SYSTEM	**Fuel Pump Type** **Recommended Gasoline** **Fuel Tank Capacity** **Operating Fuel/Oil Ratio**	Integral Automotive Unleaded with a Minimum Pump Posted Octane Rating of 87 6.6 U.S. Gallons 50:1
OIL	**Recommended Oil (Pre-Mix @ 50:1)**	NMMA TC-W II or TC-W III 2-Cycle Outboard Oil
STARTING SYSTEM	**Manual Start** **Rope Length** **Electric Start** **Ampere Draw (cranking)**	Recoil 66 in. (1676 mm) 12 Volt 55 amperes
CHARGING SYSTEM	**Alternator Output** **BLACK Stator - 2 Magnet Flywheel (8 Pole)(4 Pulses)** **RED Stator - 4 Magnet Flywheel (10 Pole)(5 Pulses)**	 4 Amp. (48 Watt) @ 6000 RPM 6 amp (72 Watt) @ 6000 RPM
BATTERY	**Battery Rating**	465 Marine Cranking Amps (MCA) or 350 Cold Cranking Amps (CCA)

IGNITION SYSTEM **Readings taken @ 68°F (20°C).**	**Type**	Capacitor Discharge Ignition
	Spark Plug Type (NGK)	NGK BP8H-N-10
	Spark Plug Gap	0.040 in. (1.0 mm)
	Spark Plug Hex	18 mm
	Firing Order	1-2
	20 Jet 1994$^{1}/_{2}$ THRU 1998	
	20/25 1994$^{1}/_{2}$ THRU 1996	
	Electronic Spark Advance	
	Idle @ 750 ± 50 RPM (In Forward Gear)	4° ± 2° B.T.D.C (Not Adjustable)
	Fast Idle Speed	1400 RPM ± 250 RPM
	Maximum BTDC (Running)	25° ± 1 @5500 RPM
	Setup Timing	28° B.T.D.C. @ 3000 ± 200 R.P.M. (Set-up timing of 28° B.T.D.C. will be retarded to 25° B.T.D.C. @ 5500 R.P.M.)
	Stator High Speed Winding	100 – 180 Ω (RED – BLK)
	Stator Low Speed Winding	2900 – 3500 Ω (BLUE – BLACK)
	Diode Test	2800 – 3400 Ω (RED – BLUE)
	Ignition Coil Resistance:	
	Primary	0 Ω
	Secondary (w/o Boots)	850 – 1200 Ω
	20 Jet 1999 and Newer	
	20/25 1997/98 Models	
	Mechanical Spark Advance	
	Idle @ 750 ± 50 RPM (In Forward Gear)	6° ± 1° B.T.D.C
	Fast Idle Speed	1500 RPM ± 200 RPM
	Maximum BTDC (Running)	25° ± 1 @5500 RPM
	Stator High Speed Winding	120 - 180 Ω (BLK/WHT - GRD)
	Stator Low Speed Winding	3200 - 3800 Ω (BLK/YEL - GRD)
	Diode Test	3100 – 3700 Ω (BLK/YEL - BLK/WHT)
	Ignition Coil Resistance:	
	Primary	0.02 - 0.04 Ω
	Secondary (w/o Boots)	8000 - 11000 Ω
	Trigger	6500 - 8500 Ω
JET DRIVE	**Impeller Liner Clearance**	0.030 in. (0.8 mm)

* Use NGK BPZ8H-N-10 Where Radio Frequency Interference (RFI) Suppression is Required.

Master Specifications

CARBURETOR SPECIFI-CATIONS	**Idle RPM (In Forward Gear)**	750 ± 50
	Wide Open Throttle (WOT) RPM	
	20	4500 - 5500
	25	5000 - 6000
	Idle Mixture Screw Adjustment (Preset-Turns Out)	
	20	1 ± 1/4 Turn
	20 Jet	1-1/2 ± 1/2 Turn
	25/25 Seapro/25 Marathon	1-1/4 ± 1/4 Turn
	Float Level	1.0 in. (25.4 mm)
	Main Jet Size	
	1994$^{1}/_{2}$ thru 1996	
	-20 (WMC-44)	0.044 in. (1.12 mm)
	-25/20 Jet (WMC-45)	0.076 in. (1.93 mm)
	-25 Seapro/Marathon (WMC-46)	0.076 in. (1.93 mm)
	-25 Seapro/Marathon (WMC-46A)	0.080 in. (2.03 mm)
	1997 and Newer	
	-20 Jet (WMC-45)	0.076 in. (1.93 mm)
	-20 (WMC-52)	0.044 in. (1.12 mm)
	-25 (WMC-53)	0.076 in. (1.93 mm)
	-25 Seapro/Marathon (WMC-54)	0.080 in. (2.03 mm)
TIMING SPECIFI-CATIONS	**20 Jet 1994$^{1}/_{2}$ THRU 1998**	
	20/25 1994$^{1}/_{2}$ THRU 1996	
	Electronic Spark Advance	
	Idle @ 750 ± 50 RPM (In Forward Gear)	4° ± 2° B.T.D.C (Not Adjustable)
	Fast Idle Speed	1400 RPM ± 250 RPM
	Maximum BTDC (Running)	25° ± 1 @5500 RPM
	Setup Timing	28° B.T.D.C. @ 3000 ± 200 R.P.M. (Set-up timing of 28° B.T.D.C. will be retarded to 25° B.T.D.C. @ 5500 R.P.M.)
	20/25 1997 AND NEWER	
	20 Jet 1999 AND NEWER	
	Mechanical Spark Advance	
	Idle @ 750 ± 50 RPM (In Forward Gear)	6° ± 1° B.T.D.C
	Fast Idle Speed	1500 RPM ± 200 RPM
	Maximum BTDC (Running)	25° ± 1 @5500 RPM

IMPORTANT INFORMATION

Section 1B - Maintenance

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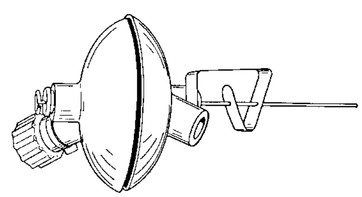
Specifications

Gear Case Lubricant Capacity

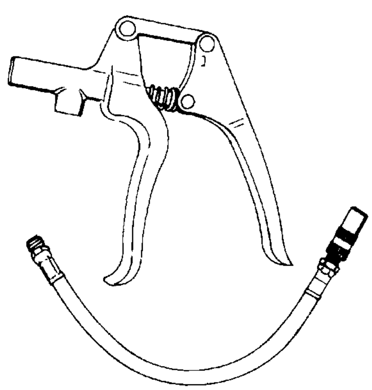
Gear Case Ratio	Capacity
2.25:1	8.8 fl. oz. (260.0ml)

Special Tools

1. Flushing Attachment 44357A2

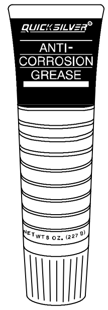


2. Grease Gun 91-37299A1

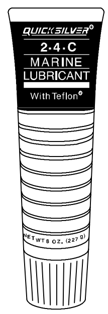


Quicksilver Lubricant/Sealant

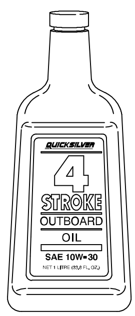
1. Quicksilver Anti-Corrosion Grease P/N 92-78376A6



2. 2-4-C Marine Lubricant with Teflon P/N 92-825407A12



3. SAE 30W Motor Oil P/N 92-97959



4. Quicksilver Gear Lubricant P/N 92-19007A24

Inspection and Maintenance Schedule

Before Each Use

1. Check that lanyard stop switch stops the engine.
2. Visually inspect the fuel system for deterioration or leaks.
3. Check outboard for tightness on transom.
4. Check steering system for binding or loose components.
5. Visually check steering link rod fasteners for proper tightness.
6. Check propeller blades for damage.

After Each Use

1. Flush out the outboard cooling system if operating in salt or polluted water.
2. Wash off all salt deposits and flush out the exhaust outlet of the propeller and gear case with fresh water if operating in salt water.

Every 100 Hours of Use or Once Yearly, Whichever Occurs First

1. Lubricate all lubrication points. Lubricate more frequently when used in salt water.
2. Inspect and clean spark plugs.
3. Check fuel line filter for contaminants.
4. Check carburetor adjustments, if required.
5. Check corrosion control anodes. Check more frequently when used in salt water.
6. Drain and replace gear case lubricant.
7. Lubricate splines on the drive shaft.*
8. Electric start models – Inspect battery.
9. Remote control models – Check control cable adjustments. *
10. Remove engine deposits with Quicksilver Power Tune Engine Cleaner.
11. Check tightness of bolts, nuts, and other fasteners.
12. Clean fuel tank pick up filter.

Every 300 Hours of Use or Three Years

1. Replace water pump impeller (more often if overheating occurs or reduced water pressure is noted).*

* *These items should be serviced by an authorized dealer.*

Flushing The Cooling System

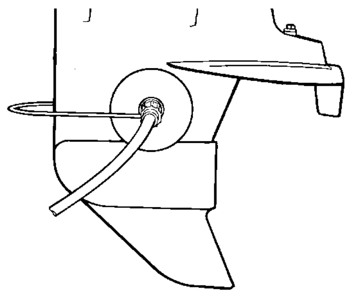
Flush the internal water passages of the outboard with fresh water after each use in salt, polluted, or muddy water. This will help prevent a buildup of deposits from clogging the internal water passages.

Use a Quicksilver accessory (or equivalent) flushing attachment.

⚠ WARNING

To avoid possible injury when flushing, remove the propeller. Refer to Propeller Replacement.

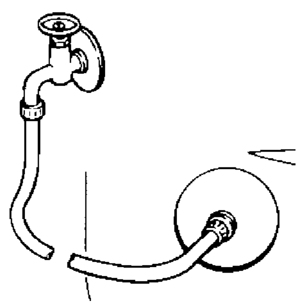
1. Remove propeller (refer to Propeller Replacement). Install the flushing attachment so the rubber cups fit tightly over the cooling water intake holes.



⚠ CAUTION

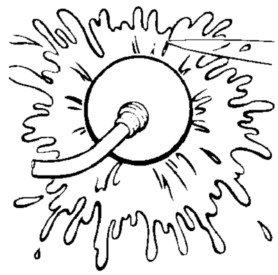
Never start or run your outboard (even momentarily) without water circulating through the cooling water intake in the gear case to prevent damage to the water pump (running dry) or overheating of the engine.

2. Attach a water hose to the flushing attachment. Turn on the water and adjust the flow so water is leaking around the rubber cups to ensure the engine receives an adequate supply of cooling water.



3. Start the engine and run it at idle speed in neutral shift position.

4. Adjust water flow (if necessary) so excess water continues leaking out from around the rubber cups to ensure the engine is receiving an adequate supply of cooling water.



5. Check for a steady stream of water flowing out of the water pump indicator hole. Continue flushing the outboard for 3 to 5 minutes, carefully monitoring water supply at all times.
6. Stop the engine, turn off the water, and remove the flushing attachment. Reinstall the propeller.

Fuel System

⚠ WARNING

Avoid serious injury or death from gasoline fire or explosion. Carefully follow all fuel system service instructions. Always stop the engine and DO NOT smoke or allow open flames or sparks in the area while servicing any part of the fuel system.

Before servicing any part of the fuel system, stop engine and disconnect the battery. Drain the fuel system completely. Use an approved container to collect and store fuel. Wipe up any spillage immediately. Material used to contain spillage must be disposed of in an approved receptacle. Any fuel system service must be performed in a well ventilated area. Inspect any completed service work for sign of fuel leakage.

Fuel Line Inspection

Visually inspect the fuel line and primer bulb for cracks, swelling, leaks, hardness or other signs of deterioration or damage. If any of these conditions is found, the fuel line or primer bulb must be replaced.

Engine Fuel Filter

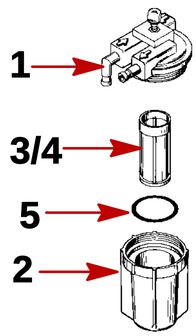
Inspect the sight bowl for water accumulation and inspect the filter element for sediment. Clean filter as follows.

REMOVAL

1. Hold onto the cover to prevent it from turning.
2. Turn off the sight bowl.
3. Pull out the filter element and wash it with cleaning solvent.

INSTALLATION

1. Push the filter element (with open end toward cover) into cover.
2. Place the O-ring seal into the sight bowl and screw the sight bowl hand tight into the cover.

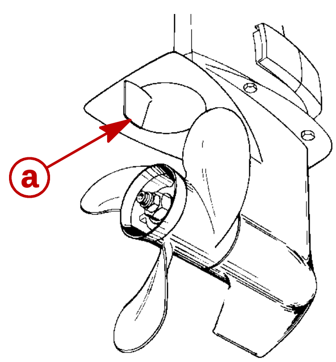


3. Visually inspect for fuel leakage around the sight bowl by squeezing the primer bulb until firm, forcing fuel into the sight bowl.

Corrosion Control Anode

Your outboard has a corrosion control anode installed to the gear case. An anode helps protect the outboard against galvanic corrosion by sacrificing its metal to be slowly eroded instead of the outboard metals.

The anode requires periodic inspection especially in salt water which will accelerate the erosion. To maintain this corrosion protection, always replace the anode before it is completely eroded. Never paint or apply a protective coating on the anode as this will reduce effectiveness of the anode.

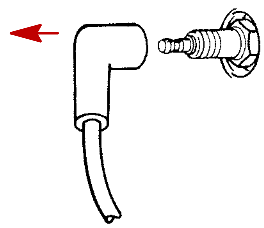


a - Anode

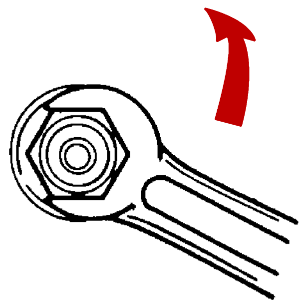
Spark Plug Inspection

Inspect spark plugs at the recommended intervals.

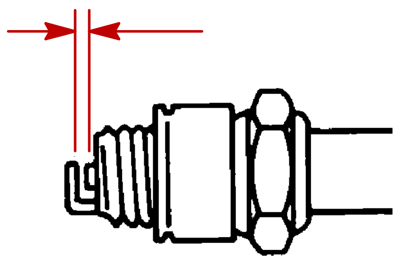
1. Remove the spark plug leads by twisting the rubber boots slightly and pull off.



2. Remove the spark plugs to inspect and clean. Replace spark plug if electrode is worn or the insulator is rough, cracked, broken, blistered or fouled.



3. Set the spark plug gap. See Specification Chart in General Information Section.



4. Before reinstalling spark plugs, clean away dirt on the spark plug seats. Install plugs finger tight, and tighten 1/4 turn or torque to 20 lb. ft. (27.1 N·m).

Battery Inspection

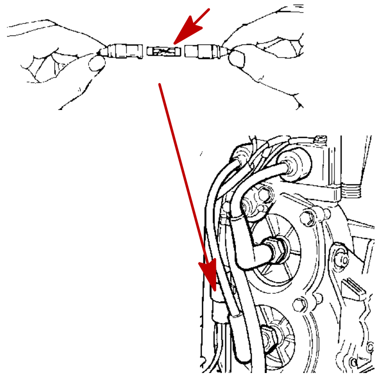
The battery should be inspected at periodic intervals to ensure proper engine starting capability.

IMPORTANT: Read the safety and maintenance instructions which accompany your battery.

1. Turn off the engine before servicing the battery.
2. Add water as necessary to keep the battery full.
3. Make sure the battery is secure against movement.
4. Battery cable terminals should be clean, tight, and correctly installed. Positive to positive and negative to negative.
5. Make sure the battery is equipped with a nonconductive shield to prevent accidental shorting of battery terminals.

Fuse Replacement – Electric Start Remote Control Models

The electric starting circuit is protected from overload by a SFE 20 AMP fuse. If the fuse is blown, the electric starter motor will not operate. Try to locate and correct the cause of the overload. If the cause is not found, the fuse may blow again. Replace the fuse with a fuse of the same rating.

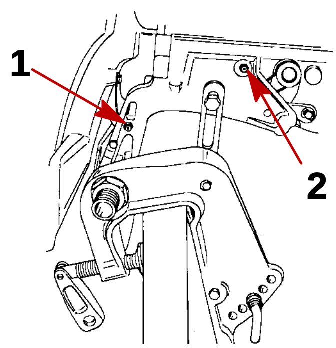


Replace with a new SFE 20 AMP fuse.

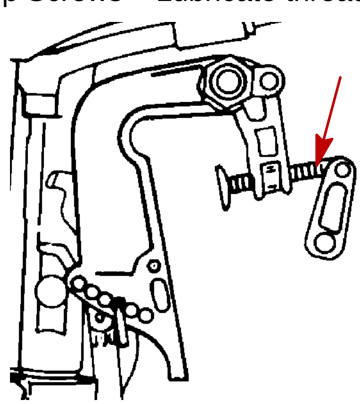
Lubrication Points

Lubricate Points 1 thru 6 with Quicksilver 2-4-C Marine Lubricant with Teflon or Special Lubricant 101.

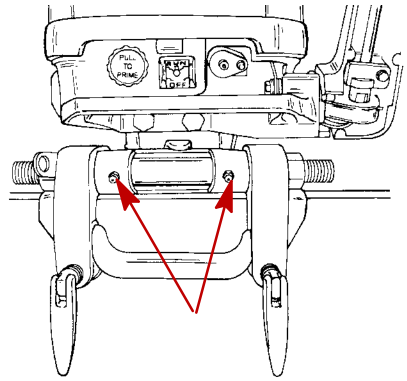
1. Steering Friction Adjustment Shaft (Tiller Handle Models) – Lubricate fitting.
2. Swivel Bracket – Lubricate fitting.



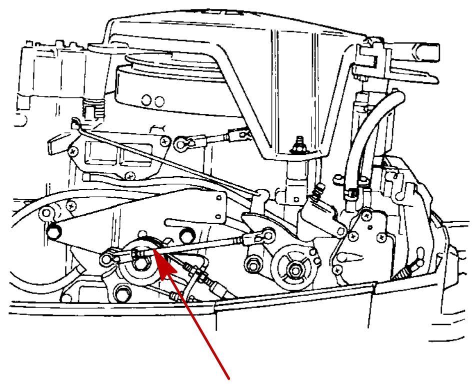
3. Transom Clamp Screws – Lubricate threads.



4. Tilt Tube – Lubricate fittings.



5. Lubricate the throttle and shaft cables, moving components and pivot locations.



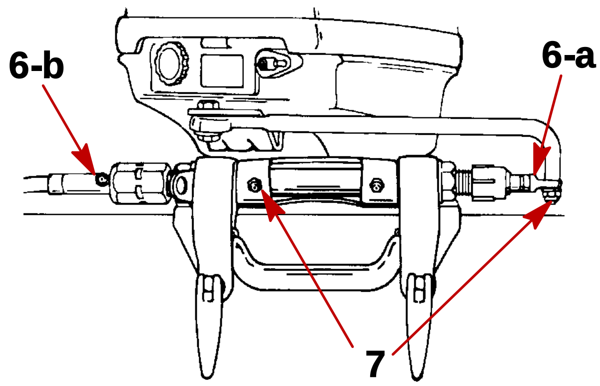
⚠ WARNING

The end of the steering cable must be fully retracted into the outboard tilt tube before adding lubricant. Adding lubricant to steering cable when fully extended could cause steering cable to become hydraulically locked. An hydraulically locked steering cable will cause loss of steering control, possibly resulting in serious injury or death.

6. Steering Cable Grease Fitting (If Equipped) – Rotate steering wheel to fully retract the steering cable end (a) into the outboard tilt tube. Lubricate through fitting (b).

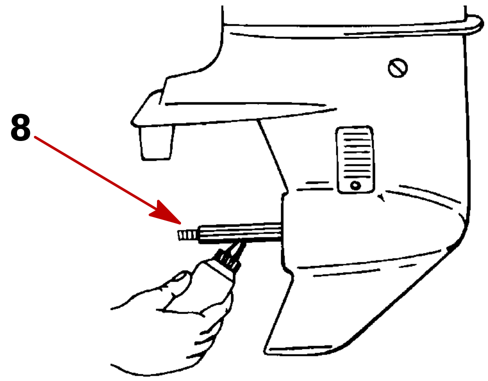
Lubricate points 7 With Light Weight Oil

7. Steering Link Rod Pivot Points – Lubricate points.



Lubricate Point 8 with Quicksilver Anti-Corrosion Grease or 2-4-C Marine Lubricant with Teflon.

8. Propeller Shaft – Refer to Propeller Replacement for removal and installation of the propeller. Coat the entire propeller shaft with lubricant to prevent the propeller hub from corroding to the shaft.



Gear Case Lubrication

Gear Case Lubricant Capacity

Gear Case Ratio	Capacity
2.25:1	8.8 fl. oz. (260.0ml)

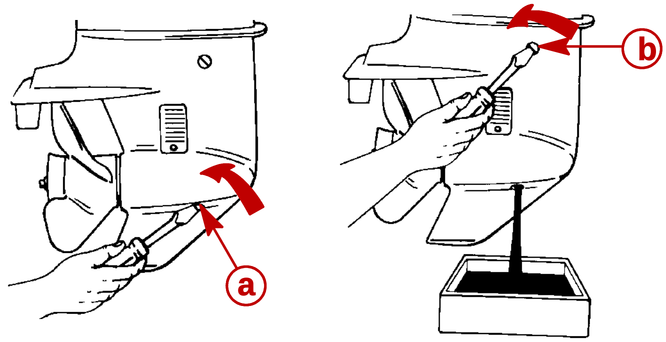
Draining Gear Case

When adding or changing gear case lubricant, visually check for the presence of water in the lubricant. If water is present, it may have settled to the bottom and will drain out prior to the lubricant, or it may be mixed with the lubricant, giving it a milky colored appearance. If water is noticed, have the gear case checked by your dealer. Water in the lubricant may result in premature bearing failure or, in freezing temperatures, will turn to ice and damage the gear case.

Whenever you remove the fill/drain plug, examine the magnetic end for metal particles. A small amount of metal filings or fine metal particles indicates normal gear wear. An excessive amount of metal filings or larger particles (chips) may indicate abnormal gear wear and should be checked by an authorized dealer.

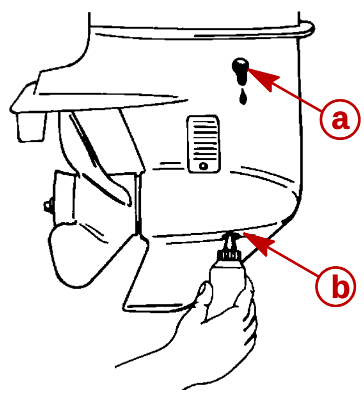
Draining Gear Case

1. Place outboard in a vertical operating position.
2. Place drain pan below outboard.
3. Remove fill/drain plug (a) and vent plug (b) and drain lubricant.

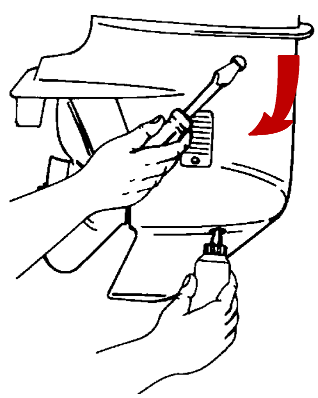


Checking Lubricant Level and Refilling Gear Case

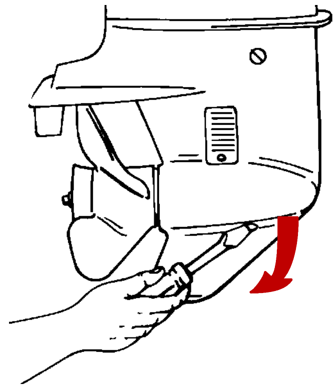
1. Place outboard in a vertical operating position.
2. Remove vent plug from vent hole (a).
3. Place lubricant tube into the fill hole (b) and add lubricant until it appears at the vent hole (a).



4. Stop adding lubricant. Install the vent plug and sealing washer before removing the lubricant tube.



5. Remove lubricant tube and reinstall cleaned fill/drain plug and sealing washer.



Storage Preparations

Fuel System

IMPORTANT: Gasoline containing alcohol (ethanol or methanol) can cause a formation of acid during storage and can damage the fuel system. If the gasoline being used contains alcohol, It is advisable to drain as much of the remaining gasoline as possible from the fuel tank, remote fuel line, and engine fuel system.

Fill the fuel system (tank, hoses, fuel pumps, and fuel injection systems) with treated (stabilized) fuel to help prevent formation of varnish and gum. Proceed with following instructions.

1. Portable Fuel Tank – Pour the required amount of Quicksilver Gasoline Stabilizer (follow instructions on container) into fuel tank. Tip fuel tank back and forth to mix stabilizer with the fuel.
2. Permanently Installed Fuel Tank – Pour the required amount of Quicksilver Gasoline Stabilizer (follow instructions on container) into a separate container and mix with approximately one quart (one liter) of gasoline. Pour this mixture into fuel tank.
3. Place the outboard in water or connect flushing attachment for circulating cooling water. Run the engine for ten minutes to allow treated fuel to fill the fuel system.

Protecting External Engine Components

1. Lubricate all outboard components listed in the Inspection and Maintenance Schedule.
2. Touch up any paint nicks.
3. Spray Quicksilver Corrosion Guard on external metal surfaces (except corrosion control anodes).

Protecting Internal Engine Components

NOTE: *Before performing Steps 1 and 2, make sure the fuel system has been prepared for storage.*

1. Place the outboard in water or connect flushing attachment for circulating cooling water. Start the engine and let it run in neutral to warm up.
2. With engine running at fast idle, stop the fuel flow by disconnecting the remote fuel line. When engine begins to stall, quickly spray Quicksilver Storage Seal into carburetor until engine stops from lack of fuel.
3. Remove the spark plugs and inject a five second spray of Quicksilver Storage Seal around the inside of each cylinder.

4. Rotate the flywheel manually several times to distribute the storage seal in the cylinders. Reinstall spark plugs.

Gear Case

Drain and refill the gear case lubricant (refer to maintenance procedure).

Positioning Outboard for Storage

Store outboard in an upright position to allow water to drain out of outboard.

CAUTION

If outboard is stored tilted up in freezing temperature, trapped cooling water or rain water that may have entered the propeller exhaust outlet in the gear case could freeze and cause damage to the outboard.

Battery Storage

1. Follow the battery manufacturers instructions for storage and recharging.
2. Remove the battery from the boat and check water level. Recharge if necessary.
3. Store the battery in a cool, dry place.
4. Periodically check the water level and recharge the battery during storage.

IMPORTANT INFORMATION

Section 1C - General Information

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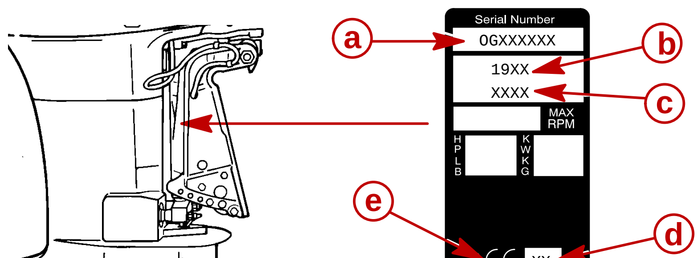
Serial Number Location

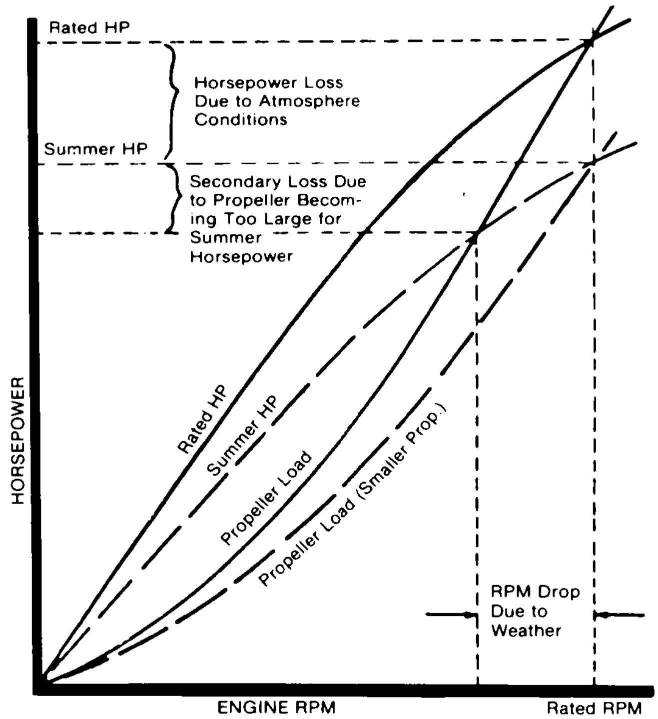
The Outboard serial number is located on the lower starboard side of the engine block. A serial number is also located on the starboard side of the swivel bracket.



a - Serial Number
b - Model Year
c - Model Description
d - Year Manufactured
e - Certified Europe Insignia

Conditions Affecting Performance

Weather



It is a known fact that weather conditions exert a profound effect on power output of internal combustion engines. Therefore, established horsepower ratings refer to the power that the engine will produce at its rated RPM under a specific combination of weather conditions.

Corporations internationally have settled on adoption of I.S.O. (International Standards Organization) engine test standards, as set forth in I.S.O. 3046 standardizing the computation of horsepower from data obtained on the dynamometer, correcting all values to the power that the engine will produce at sea level, at 30% relative humidity at 77° F (25° C) temperature and a barometric pressure of 29.61 inches of mercury.

Summer Conditions of high temperature, low barometric pressure and high humidity all combine to reduce the engine power. This, in turn, is reflected in decreased boat speeds--as much as 2 or 3 miles-per-hour (3 or 5 Km per-hour) in some cases. (Refer to previous chart.) Nothing will regain this speed for the boater, but the coming of cool, dry weather.

In pointing out the practical consequences of weather effects, an engine--running on a hot, humid summer day--may encounter a loss of as much as 14% of the horsepower it would produce on a dry, brisk spring or fall day. The horsepower, that any internal combustion engine produces, depends upon the density of the air that it consumes and, in turn, this density is dependent upon the temperature of the air, its barometric pressure and water vapor (or humidity) content.

Accompanying this weather-inspired loss of power is a second but more subtle loss. At rigging time in early spring, the engine was equipped with a propeller that allowed the engine to turn within its recommended RPM range at full throttle. With the coming of the summer weather and the consequent drop in available horsepower, this propeller will, in effect, become too large. Consequently, the engine operates at less than its recommended RPM.

Due to the horsepower/RPM characteristics of an engine, this will result in further loss of horsepower at the propeller with another decrease in boat speed. This secondary loss, however, can be regained by switching to a smaller pitch propeller that allows the engine to again run at recommended RPM.

For boaters to realize optimum engine performance under changing weather conditions, it is essential that the engine have the proper propeller to allow it to operate at or near the top end of the recommended maximum RPM range at wide-open-throttle with a normal boat load.

Not only does this allow the engine to develop full power, but equally important is the fact that the engine also will be operating in an RPM range that discourages damaging detonation. This, of course, enhances overall reliability and durability of the engine.

Boat

WEIGHT DISTRIBUTION

1. Proper positioning of the weight inside the boat (persons and gear) has a significant effect on the boat's performance, for example:
   a. Shifting weight to the rear (stern)
      (1.) Generally increases top speed.
      (2.) If in excess, can cause the boat to porpoise.
      (3.) Can make the bow bounce excessively in choppy water.
      (4.) Will increase the danger of the following - wave splashing into the boat when coming off plane.
   b. Shifting weight to the front (bow)
      (1.) Improves ease of planing off.
      (2.) Generally improves rough water ride.
      (3.) If excessive, can make the boat veer left and right (bow steer).

BOTTOM

For maximum speed, a boat bottom should be nearly a flat plane where it contacts the water and particularly straight and smooth in fore-and-aft direction.

1. **Hook:** Exists when bottom is concave in fore-and-aft direction when viewed from the side. When boat is planing, "hook" causes more lift on bottom near transom and allows bow to drop, thus greatly increasing wetted surface and reducing boat speed. "Hook" frequently is caused by supporting boat too far ahead of transom while hauling on a trailer or during storage.
2. **Rocker:** The reverse of hook and much less common. "Rocker" exists if bottom is convex in fore-and-aft direction when viewed from the side, and boat has strong tendency to porpoise.
3. **Surface Roughness:** Moss, barnacles, etc., on boat or corrosion of outboard's gear housing increase skin friction and cause speed loss. Clean surfaces when necessary.

WATER ABSORPTION

It is imperative that all through hull fasteners be coated with a quality marine sealer at time of installation. Water intrusion into the transom core and/or inner hull will result in additional boat weight (reduced boat performance), hull decay and eventual structural failure.

CAVITATION

Cavitation is caused by water vapor bubbles forming either from a sharp edge or angle on the gear case or from an irregularity in the propeller blade itself. These vapor bubbles flow back and collapse when striking the surface of the propeller blade resulting in the erosion of the propeller blade surface. If allowed to continue, eventual blade failure (breakage) will occur.

Engine

DETONATION

Detonation in a 2-cycle engine resembles the “pinging” heard in an automobile engine. It can be otherwise described as a tin-like “rattling” or “plinking” sound.

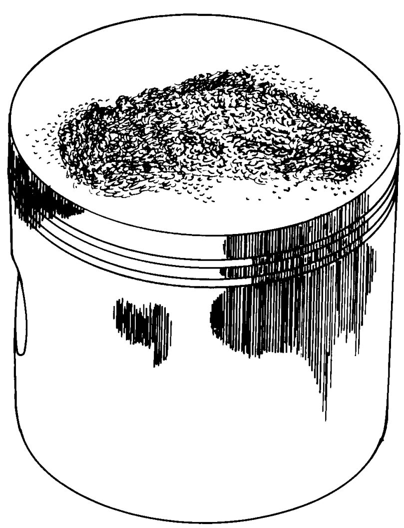
Detonation is an explosion of an unburned portion of the fuel/air charge after the spark plug has fired. Detonation creates severe shock waves in the engine, and these shock waves often find or create a weakness: The dome of a piston, cylinder head/gasket, piston rings or piston ring lands, piston pin and roller bearings.

A few of the most common causes of detonation in a marine 2-cycle application are as follows:

- Over-advanced ignition timing.
- Use of low octane gasoline.
- Propeller pitch too high (engine RPM below recommended maximum range).
- Lean fuel mixture at or near wide-open-throttle.
- Spark plugs (heat range too hot - incorrect reach - cross-firing).
- Inadequate engine cooling (deteriorated cooling system).
- Combustion chamber/piston deposits (result in higher compression ratio).

Detonation usually can be prevented if:

1. The engine is correctly set up.
2. Diligent maintenance is applied to combat the detonation causes.



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Damaged Piston Resulting from Detonation

Following Complete Submersion

Submerged While Running (Special Instructions)

When an engine is submerged while running, the possibility of internal engine damage is greatly increased. If, after engine is recovered and with spark plugs removed, engine fails to turn over freely when turning flywheel, the possibility of internal damage (bent connecting rod and/or bent crankshaft) exists. If this is the case, the powerhead must be disassembled.

Salt Water Submersion (Special Instructions)

Due to the corrosive effect of salt water on internal engine components, complete disassembly is necessary before any attempt is made to start the engine.

Fresh Water Submersion (Special Instructions)

1. Recover engine as quickly as possible.
2. Remove cowling.
3. Flush exterior of outboard with fresh water to remove mud, weeds, etc. DO NOT attempt to start engine if sand has entered powerhead, as powerhead will be severely damaged. Disassemble powerhead if necessary to clean components.
4. Remove spark plugs and get as much water as possible out of powerhead. Most water can be eliminated by placing engine in a horizontal position (with spark plug holes down) and rotating flywheel.
5. Pour alcohol into carburetor throats (alcohol will absorbed water). Again rotate flywheel.
6. Turn engine over and pour alcohol into spark plug openings and rotate flywheel.
7. Turn engine over (place spark plug openings down) and pour engine oil into throat of carburetors while rotating flywheel to distribute oil throughout crankcase.
8. Again turn engine over and pour approximately one teaspoon of engine oil into each spark plug opening. Again rotate flywheel to distribute oil in cylinders.
9. Remove and clean carburetors and fuel pump assembly.
10. Dry all wiring and electrical components using compressed air.
11. Disassemble the engine starter motor and dry the brush contacts, armature and other corrodible parts.
12. Reinstall spark plugs, carburetors and fuel pump.
13. Attempt to start engine, using a fresh fuel source. If engine starts, it should be run for at least one hour to eliminate any water in engine.
14. If engine fails to start, determine cause (fuel, electrical or mechanical). Engine should be run within 2 hours after recovery of outboard from water, or serious internal damage may occur. If unable to start engine in this period, disassemble engine and clean all parts. Apply oil as soon as possible.

Propeller Selection

For in-depth information on marine propellers and boat performance - written by marine engineers - see your Authorized Dealer for the illustrated "**What You Should Know About Quicksilver Propellers... and Boat Performance Information**" (Part No. 90-86144).

For best all around performance from your outboard/boat combination, select a propeller that allows the engine to operate in the upper half of the recommended full throttle RPM range with the boat normally loaded (refer to Specifications). This RPM range allows for better acceleration while maintaining maximum boat speed.

If changing conditions cause the RPM to drop below the recommended range (such as warmer, more humid weather, operation at higher elevations, increased boat load or a dirty boat bottom/gear case) a propeller change or cleaning may be required to maintain performance and ensure the outboard's durability.

Check full-throttle RPM using an accurate tachometer with the engine trimmed out to a balanced-steering condition (steering effort equal in both directions) without causing the propeller to "break loose".

Refer to "Quicksilver Accessory Guide" for a complete list of available propellers.

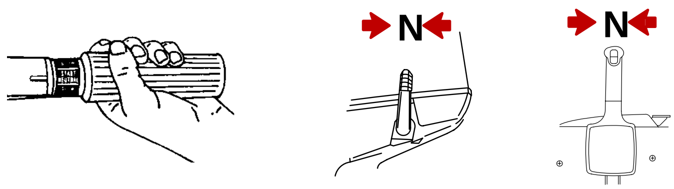
1. Select a propeller that will allow the engine to operate at or near the top of the recommended full throttle RPM range (listed in "**Specifications**," preceding) with a normal load. Maximum engine speed (RPM) for propeller selection exists when boat speed is maximum and trim is minimum for that speed. (High RPM, caused by an excessive trim angle, should not be used in determining correct propeller.) Normally, there is a 150-350 RPM change between propeller pitches.
2. If full throttle operation is below the recommended range, the propeller MUST BE changed to one with a lower pitch to prevent loss of performance and possible engine damage.
3. After initial propeller installation, the following common conditions may require that the propeller be changed to a lower pitch:
   a. Warmer weather and great humidity will cause an RPM loss.
   b. Operating in a higher elevation causes an RPM loss.
   c. Operating with a damaged propeller or a dirty boat bottom or gear housing will cause an RPM loss.
   d. Operation with an increased load (additional passengers, equipment, pulling skiers, etc.).

Propeller Removal/Installation

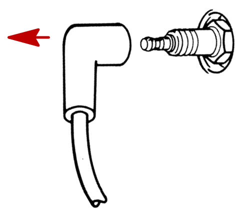
⚠ WARNING

If the propeller shaft is rotated while the engine is in gear, there is the possibility that the engine will crank over and start. To prevent this type of accidental engine starting and possible serious injury caused from being struck by a rotating propeller, always shift outboard to neutral position and remove spark plug leads when you are servicing the propeller

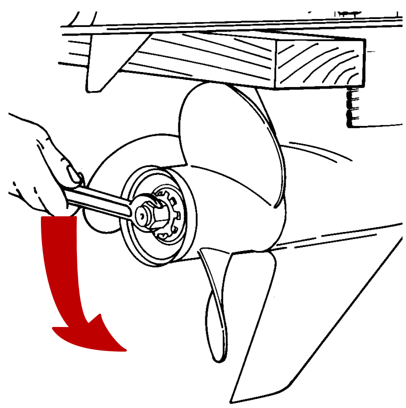
1. Shift outboard to neutral position.



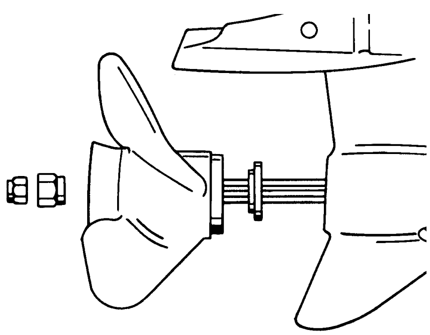
2. Remove the spark plug leads to prevent engine from starting.



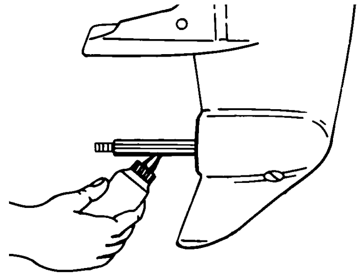
3. Place a block of wood between gear case and propeller to hold propeller and remove propeller nut.



4. Pull propeller straight off shaft. If propeller is seized to the shaft and cannot be removed, have the propeller removed by an authorized dealer.

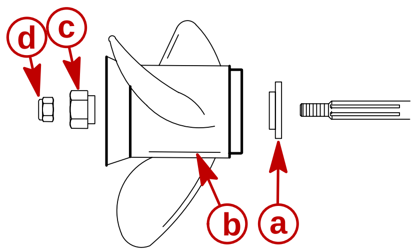


5. Coat the propeller shaft with Quicksilver Anti-Corrosion Grease or 2-4-C Marine Lubricant with Teflon.



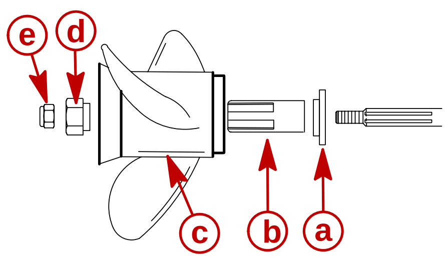
IMPORTANT: To prevent the propeller hub from corroding and seizing to the propeller shaft, especially in salt water, always apply a coat of the recommended lubricant to the entire propeller shaft at the recommended maintenance intervals and also each time the propeller is removed.

6. Flo-Torque I Drive Hub Propellers – Install forward thrust hub, propeller, rear thrust hub and propeller nut onto the shaft.



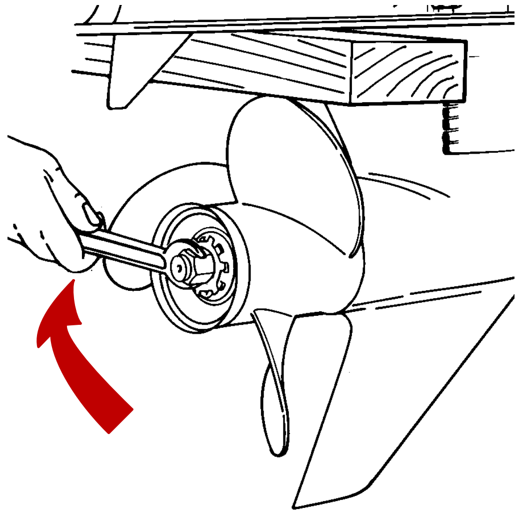
a - Forward Thrust Hub
b - Propeller
c - Rear Thrust Hub
d - Propeller Nut

7. Flo-Torque II Drive Hub Propellers – Install forward thrust hub, replaceable drive sleeve propeller, rear thrust hub and propeller nut onto the shaft.



a - Forward Thrust Hub
b - Replaceable Drive Sleeve
c - Propeller
d - Rear Thrust Hub
e - Propeller Nut

8. Place a block of wood between gear case and propeller and tighten propeller nut.



Compression Check

1. Remove spark plugs.
2. Install compression gauge in spark plug hole.
3. Hold throttle plate at W.O.T.
4. Crank the engine over until the compression reading peaks on the gauge. Record the reading.
5. Check and record compression of each cylinder. The highest and lowest reading recorded should not differ by more than 15% (see example chart below). A reading below 120 psi might indicate a total engine wear problem.

Example of compression test differences

Maximum (psi)	Minimum (psi)
180	162
150	127.5

6. Compression check is important because an engine with low or uneven compression cannot be tuned successfully to give peak performance. It is essential, therefore, that improper compression be corrected before proceeding with an engine tuneup.
7. Cylinder scoring: If powerhead shows any indication of overheating, such as discolored or scorched paint, visually inspect cylinders for scoring or other damage as outlined in Section 4 “**Powerhead**.”

Painting Procedures

Cleaning & Painting Aluminum Propellers & Gear Housings

⚠ WARNING

Avoid serious injury from flying debris. Avoid serious injury from airborne particles. Use eye and breathing protection with proper ventilation.

PROPELLERS

1. Sand the entire area to be painted with 3M 120 Regalite Polycut or coarse Scotch-Brite, disc or belts.
2. Feather edges of all broken paint edges. Try not to sand through the primer.
3. Clean the surface to be painted using PPG Industries DX330 Wax and Grease Remover or equivalent (Xylene or M.E.K.).
4. If bare metal has been exposed, use Quicksilver's Light Gray Primer.
5. Allow a minimum of 1 hour dry time and no more than 1 week before applying the finish coat.
6. Apply the finish coat using Quicksilver's EDP Propeller Black.

GEAR HOUSINGS

The following procedures should be used in refinishing gear housings. This procedure will provide the most durable paint system available in the field. The materials recommended are of high quality and approximate marine requirements. The following procedure will provide a repaint job that compares with a properly applied factory paint finish. It is recommended that the listed materials be purchased from a local Ditzler Automotive Finish Supply Outlet. The minimum package quantity of each material shown following is sufficient to refinish several gear housings.

Procedure:

1. Wash gear housing with a muriatic acid base cleaner to remove any type of marine growth, and rinse with water, if necessary.
2. Wash gear housing with soap and water, then rinse.
3. Sand blistered area with 3M 180 grit sandpaper or P180 Gold Film Disc to remove paint blisters only. Feather edge all broken paint edges.
4. Clean gear housing thoroughly with (DX-330) wax and grease remover.
5. Spot repair surfaces where bare metal is exposed with (DX-503) alodine treatment.

IMPORTANT: Do not use any type of aerosol spray paints as the paint will not properly adhere to the surface nor will the coating be sufficiently thick to resist future paint blistering.

6. Mix epoxy chromate primer (DP-40) with equal part catalyst (DP-401) per manufacturers instructions, allowing proper induction period for permeation of the epoxy primer and catalyst.
7. Allow a minimum of one hour drying time and no more than one week before top coating assemblies.
8. Use Ditzler Urethane DU9000 for Mercury Black, DU34334 for Mariner Grey, and DU35466 for Force Charcoal, and DU33414M for Sea Ray White. Catalyze all three colors with Ditzler DU5 catalyst mixed 1:1 ratio. Reduce with solvents per Ditzler label.

CAUTION

Be sure to comply with instructions on the label for ventilation and respirators. Using a spray gun, apply one half to one mil even film thickness. Let dry, flash off for five minutes and apply another even coat of one half to one mil film thickness. This urethane paint will dry to the touch in a matter of hours, but will remain sensitive to scratches and abrasions for a few days.

9. The type of spray gun used will determine the proper reduction ratio of the paint.

IMPORTANT: Do not paint sacrificial zinc trim tab or zinc anode.

10. Cut out a cardboard “plug” for trim tab pocket to keep paint off of mating surface to maintain good continuity circuitry between trim tab and gear housing.

Decal Application

Decal Removal

1. Mark decal location before removal to assure proper alignment of new decal.
2. Carefully soften decal and decal adhesive with a heat gun or heat blower while removing old decal.
3. Clean decal contact area with a 1:1 mixture of isopropyl alcohol and water.
4. Thoroughly dry decal contact area and check for a completely cleaned surface.

Instructions for “Wet” Application

NOTE: *The following decal installation instructions are provided for a “Wet” installation.* ***All*** *decals should be applied wet.*

TOOLS REQUIRED

1. Plastic Squeegee*
2. Stick Pin
3. Dish Washing **Liquid/Detergent without ammonia**** “Joy” and “Drift” are known to be compatible for this process.

* Automotive Body Filler Squeegee

** Do not use a soap that contains petroleum based solvents.

SERVICE TIP: Placement of decals using the “Wet” application will allow time to position decal. Read entire installation instructions on this technique before proceeding.

TEMPERATURE

IMPORTANT: Installation of vinyl decals should not be attempted while in direct sunlight. Air and surface temperature should be between 60°F (15°C) and 100°F (38°C) for best application.

SURFACE PREPARATION

IMPORTANT: Do not use a soap or any petroleum based solvents to clean application surface.

Clean entire application surface with mild dish washing liquid and water. Rinse surface thoroughly with clean water.

DECAL APPLICATION

1. Mix $^1/_2$ ounce (16 ml) of dish washing liquid in one gallon (4 l) of cool water to use as wetting solution.

NOTE: *Leave protective masking, if present, on the face of decal until final steps of decal installation. This will ensure that the vinyl decal keeps it's shape during installation.*

2. Place the decal face down on a clean work surface and remove the paper backing from “adhesive side” of decal.
3. Using a spray bottle, flood the entire “adhesive side” of the decal with the pre-mixed wetting solution.
4. Flood area where the decal will be positioned with wetting solution.
5. Position pre-wetted decal on wetted surface and slide into position.
6. Starting at the center of the decal, “**lightly**” squeegee out the air bubbles and wetting solution with overlapping strokes to the outer edge of the decal. Continue going over the decal surface until all wrinkles are gone and adhesive bonds to the cowl surface.
7. Wipe decal surface with soft paper towel or cloth.
8. **Wait 10 - 15 minutes.**
9. Starting at one corner, “carefully and slowly” pull the masking off the decal surface at a 180° angle.

NOTE: *To remove any remaining bubbles, pierce the decal at one end of the bubble with stick pin and press out the entrapped air or wetting solution with your thumb (moving toward the puncture).*

IMPORTANT INFORMATION

Section 1D - Outboard Motor Installation

Table of Contents

Notice to Installer and Owner

This manual as well as safety labels posted on the outboard use the following safety alerts to draw your attention to special safety instructions that should be followed.

⚠ DANGER

DANGER – Immediate hazards which WILL result in severe personal injury or death.

⚠ WARNING

WARNING – Hazards or unsafe practices which COULD result in severe personal injury or death.

⚠ CAUTION

CAUTION – Hazards or unsafe practices which could result in minor injury or product or property damage.

Boat Horsepower Capacity

U.S. COAST GUARD CAPACITY	
MAXIMUM HORSEPOWER	XXX
MAXIMUM PERSON CAPACITY (POUNDS)	XXX
MAXIMUM WEIGHT CAPACITY	XXX

Do not overpower or overload your boat. Most boats will carry a required capacity plate indicating the maximum acceptable power and load as determined by the manufacturer following certain federal guidelines. If in doubt, contact your dealer or the boat manufacturer.

WARNING

Using an outboard that exceeds the maximum horsepower limit of a boat can: 1. cause loss of boat control 2. place too much weight at the transom altering the designed flotation characteristics of the boat or 3. cause the boat to break apart particularly around the transom area. Overpowering a boat can result in serious injury, death, or boat damage.

Outboard Remote Control

The remote control connected to your outboard must be equipped with a start-in-gear protection device. This prevents the engine from starting when the outboard is in gear.

WARNING

Avoid serious injury or death from a sudden unexpected acceleration when starting your engine. The design of this outboard requires that the remote control used with it must have a built in start-in-gear protection device.

Selecting Accessories For The Outboard

Genuine Mercury Marine Quicksilver Accessories have been specifically designed and tested for your outboard.

Mercury Marine Quicksilver accessories are available from Mercury Marine dealers.

Some accessories not manufactured or sold by Mercury Marine are not designed to be safely used with your outboard or outboard operating system. Acquire and read the installation, operation, and maintenance manuals for all your selected accessories.

Selecting Steering Cables and Remote Control Cables

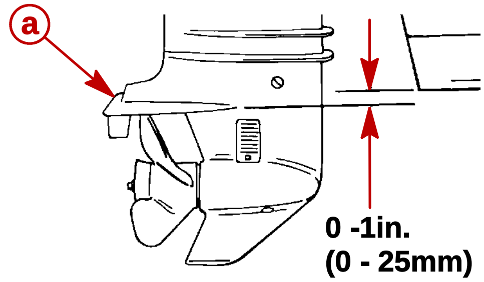
Install steering mount and steering wheel in accordance with installation instructions that accompany each.

IMPORTANT: Steering cable must be correct length. Sharp bends on too-short of a cable result in "kinks;" too-long of a cable require unnecessary bends and/or loops. Both conditions place extra stress on the cable.

Refer to "Quicksilver Accessories Guide" to determine correct length of steering cable.

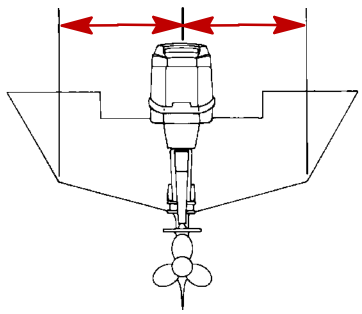
Installing Outboard

1. Measure the transom height of your boat. The boat bottom should be aligned or be within 1 in. (25mm) above the anti-ventilation plate (a) of the outboard.

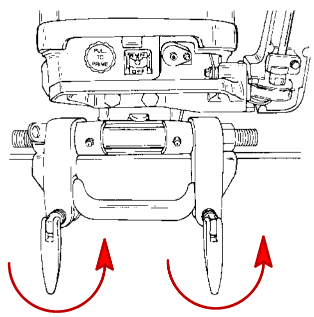


a - Anti-Ventilation Plate

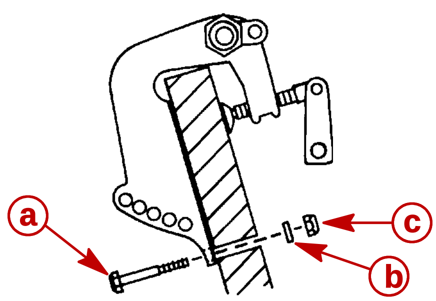
2. Place outboard on center line of transom.



3. Tighten transom clamp handles.



4. To prevent loss of outboard overboard, fasten outboard by drilling two 5/16 in. (7.9 mm) holes through the transom using transom clamp holes as a template. Fasten with two bolts, flat washers and locknuts. Use a marine waterproofing sealer in holes and around bolts to make the installation water tight.



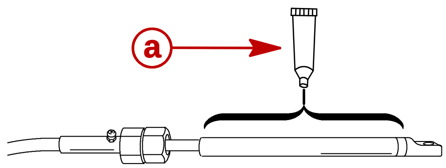
a - Bolts (2)
b - Flat Washers (2)
c - Locknuts (2)

Steering Cable and Steering Link Rod Installation

Installing Ride Guide Steering Cable to the Outboard

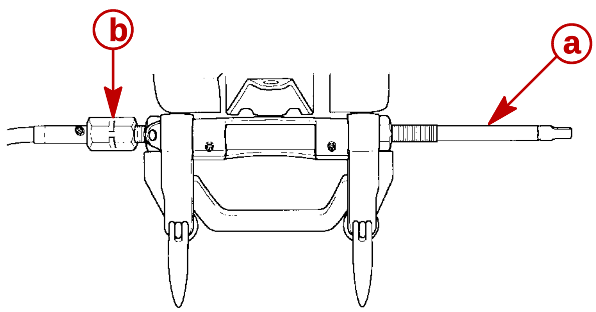
IMPORTANT: Before installing steering cable into tilt tube, lubricate entire cable end with Quicksilver 2-4-C w/Teflon Marine Lubricant (92-825407A12).

1. Lubricate the entire cable end.



a - Quicksilver 2-4-C Marine Lubricant with Teflon

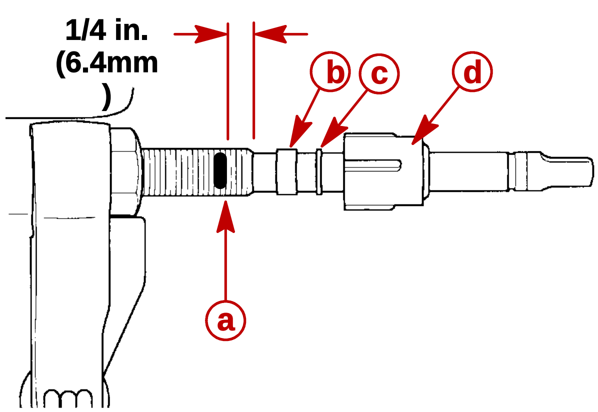
2. Insert steering cable end thru outboard tilt tube and secure steering cable to tilt tube with steering cable attaching nut as shown. Torque nut to 35 lb. ft. (47.5 N·m).



a - Cable End
b - Attaching Nut [Torque to 35 lb. ft. (47.5 N·m)].

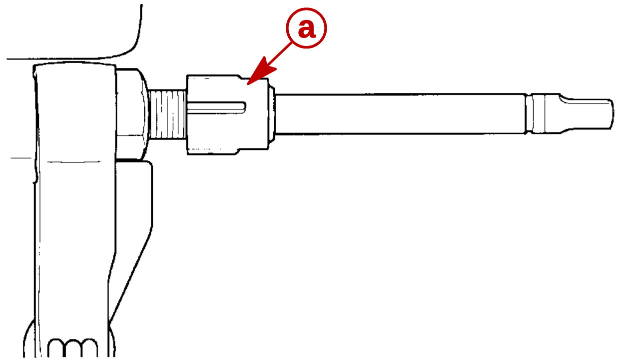
Steering Cable Seal

3. Place a mark on tilt tube 5/8 in. (15.9mm) from port end of tube. Slide plastic spacer, o-ring and cap over steering cable end, to tilt tube on engine.



a - Mark
b - Spacer
c - O-ring
d - Cap

4. Thread cap up to the 1/4 in. (6.4mm) mark.



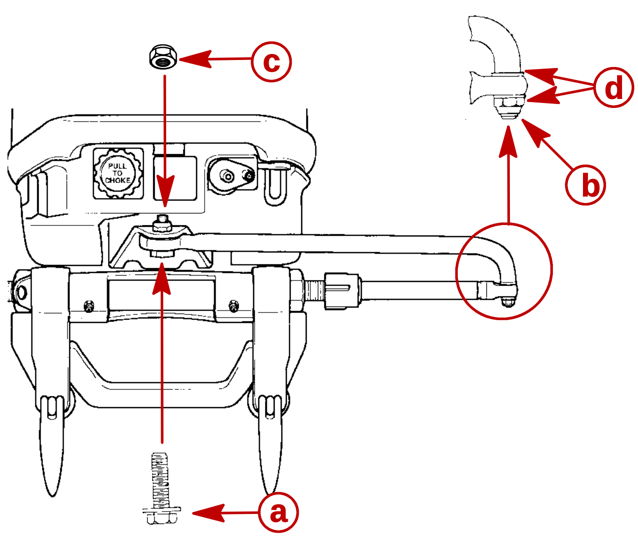
a - Cap

Steering Link Rod Installation

IMPORTANT: The steering link rod that connects the steering cable to the engine must be fastened using special washer head bolt ("a" – Part Number 10-14000) and self locking nuts ("b" & "c" – Part Number 11-34863). These locknuts must never be replaced with common nuts (non locking) as they will work loose and vibrate off freeing the link rod to disengage.

WARNING
Disengagement of a steering link rod can result in the boat taking a full, sudden, sharp turn. This potentially violent action can cause occupants to be thrown overboard exposing them to serious injury or death.

1. Assemble steering link rod to steering cable with two flat washers (d) and nylon insert locknut ("b" – Part Number 11-34863). Tighten locknut (b) until it seats, then back nut off 1/4 turn.
2. Assemble steering link rod to engine with special washer head bolt ("a" – Part Number 10-14000) and nylon insert locknut ("c" – Part Number 11-34863). First torque bolt (a) to 20 lb. ft. (27.1 N·m), then torque locknut (c) to 20 lb. ft. (27.1 N·m).



a - Bolt (10-14000)
b - Lock Nut (11-34863)
c - Lock Nut (11-34863)
d - Washers (2 each)

⚠ WARNING

After installation is complete (and before operating outboard), check that boat will turn right when steering wheel is turned right and that boat will turn left when steering wheel is turned left. Check steering thru full range (left and right) and at all tilt angles to assure interference-free movement.

Remote Control Installation

Refer to Quicksilver Accessory Guide for appropriate electric or manual remote control. Use instructions provided with control for proper installation.

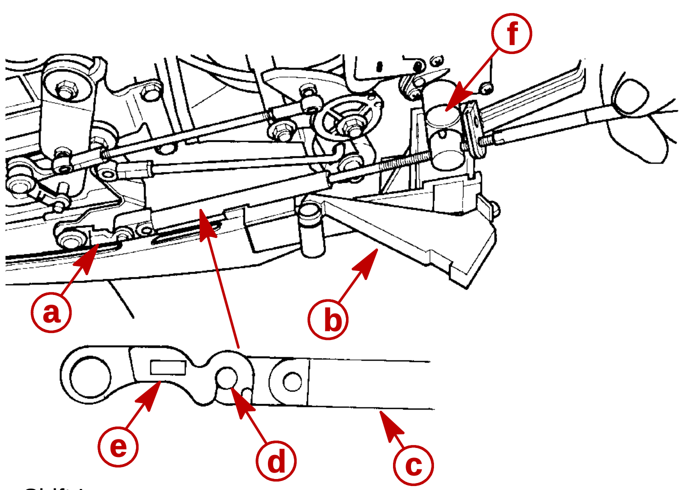
Shift and Throttle Cable Installation to the Outboard

Install the shift cable and throttle cable into the remote control and mount the remote control following instructions which are provided with the remote control.

NOTE: *Install the shift cable before the throttle cable. The shift cable is the first cable to move when the remote control handle is moved into gear.*

Shift Cable Installation

1. Move the remote control handle into full reverse position.
2. Place the engine shift lever (a) into reverse position (toward rear) while rotating propeller. The propeller shaft will not rotate in either direction when in reverse position.
3. Open up the cable retainer cover (b) and remove the barrel holder and front rubber grommet.
4. Install the shift cable (c) onto the shift lever pin (d). lock in place with retainer latch (e).
5. Adjust the shift cable barrel so it will fit into the bottom hole of the barrel holder (f)and that the barrel holder will slide freely into the retaining pocket without pre-loading the shift cable.



a - Shift Lever
b - Cable Retainer Cover
c - Shift Cable
d - Shift Lever Pin
e - Retainer Latch
f - Barrel Holder

6. Check shift cable adjustments as follows:

a. With remote control shifted into forward the propeller shaft should lock solidly in gear. If it does not, adjust the cable barrel closer to the engine shift lever.

b. Shift remote control into neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel away from the engine shift lever. Repeat steps a and b.

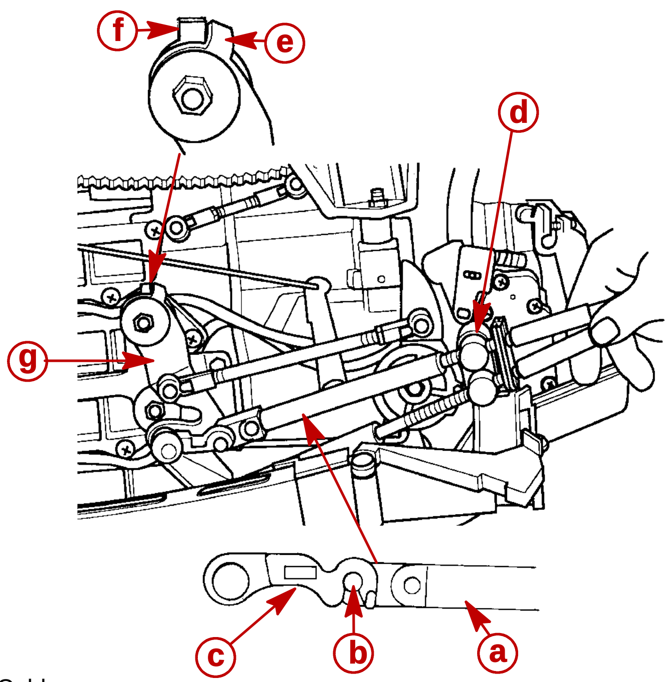
c. Shift remote control into reverse while turning the propeller shaft. The propeller shaft should lock solidly in gear. If not, adjust the barrel away from the engine shift lever. Repeat steps a thru c.

d. Return remote control handle to neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel closer to the engine shift lever. Repeat steps a thru d.

Throttle Cable Installation

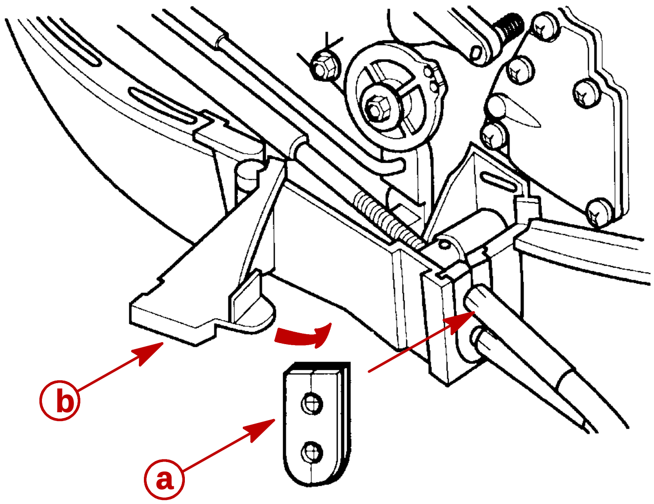
NOTE: *Attach Shift cable to engine prior to attaching throttle cable.*

1. Position the remote control handle forward, to wide-open-throttle position.
2. Install the throttle cable (a) onto the throttle pin (b). lock in place with retainer latch (c).
3. Move throttle lever (g) until tab (e) contacts throttle stop (f). Adjust the barrel on the throttle cable so that the barrel will fit into the barrel holder (d).
4. Slip the barrel into the barrel holder and place the barrel holder into the retaining pocket.
5. Check the throttle cable adjustment as follows.
   a. Move the remote control handle back to neutral a few times and then return the handle back to forward wide-open-position.
   b. Recheck to make sure tab (e) is contacting throttle stop (f).



a - Throttle Cable
b - Throttle Pin
c - Retainer Latch
d - Barrel Holder
e - Tab
f - Throttle Stop
g - Throttle Lever

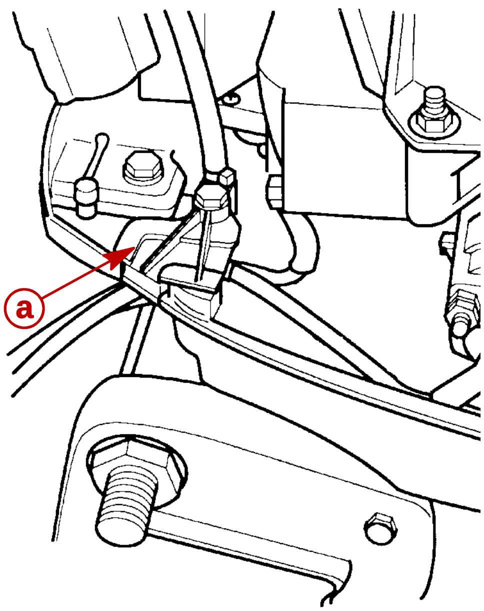
6. Place the rubber seal (side with holes towards front)) onto the control cables and install control cables, barrel holder and rubber seal into the cable holder as shown.
7. Lock the barrel holder in place with the cable retainer latch.



a - Rubber Seal
b - Cable Retainer Latch

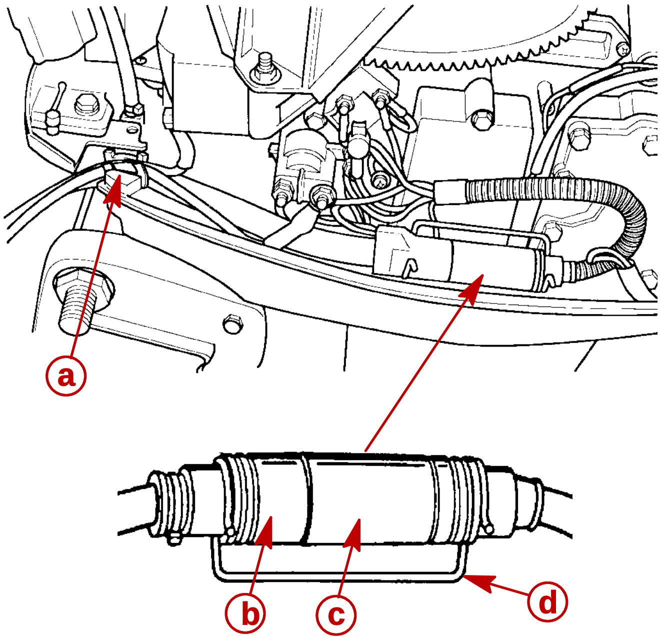
Remote Wiring Harness Connection to Engine

1. Remove wire retainer from the bottom cowl.



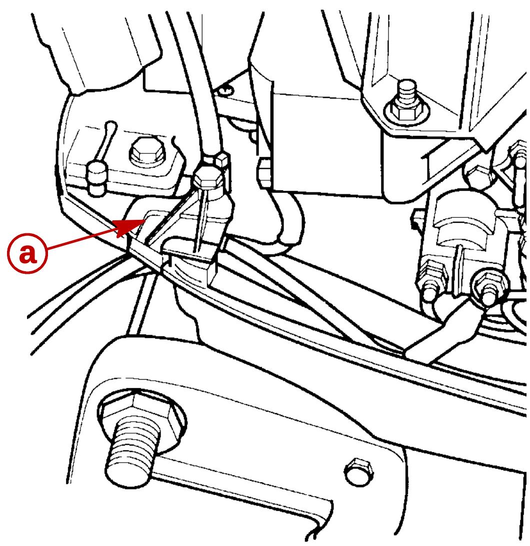
a - Wire Retainer

2. Position the remote wiring harness and battery cables thru the bottom cowl rubber grommet as shown.
3. Plug the remote wiring harness into the engine wiring harness connector.
4. Secure the connection together using retainer.



a - Rubber Grommet
b - Remote Wiring Harness
c - Engine Harness Connector
d - Retainer

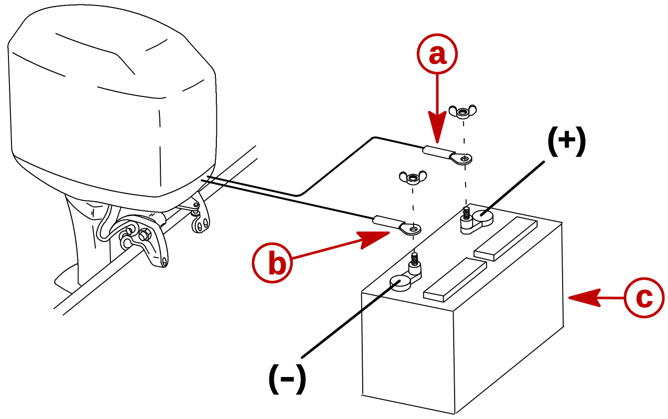
5. Fasten the remote wiring harness and battery cables into the bottom cowl rubber grommet with retainer.



a - Retainer

Battery Cable Connections

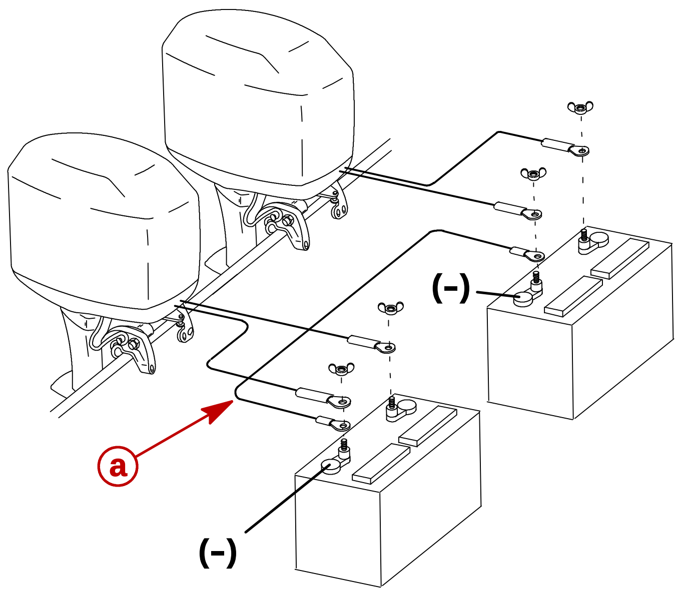
SINGLE OUTBOARD



a - RED Sleeve (POSITIVE)
b - BLACK Sleeve (NEGATIVE)
c - Starting Battery

DUAL OUTBOARD

1. Connect a common ground cable (wire size same as engine battery cables) between negative (–) terminals on starting batteries.



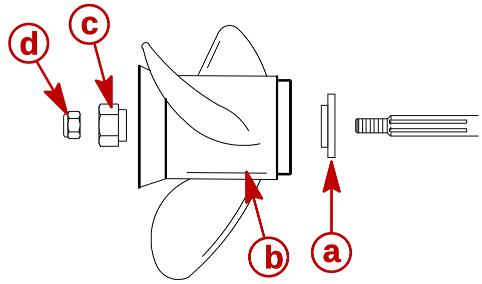
a - Ground Cable (Same Wire Size As Engine Battery Cable – Connect Between Negative (–) Terminals

Propeller Installation

⚠ WARNING

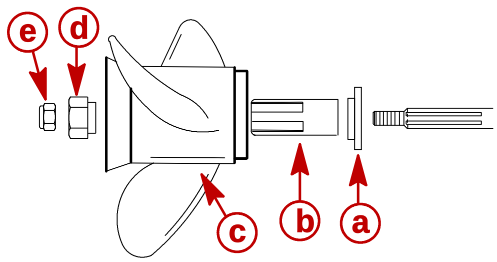
If the propeller shaft is rotated while the engine is in gear, there is the possibility that the engine will crank over and start. To prevent this type of accidental engine starting and possible serious injury caused from being struck by a rotating propeller, always shift outboard to neutral position and remove spark plug leads when you are servicing the propeller.

Flo-Torq I Drive Hub Propellers



a - Forward Thrust Hub
b - Propeller
c - Rear Thrust Hub
d - Propeller Nut – Tighten

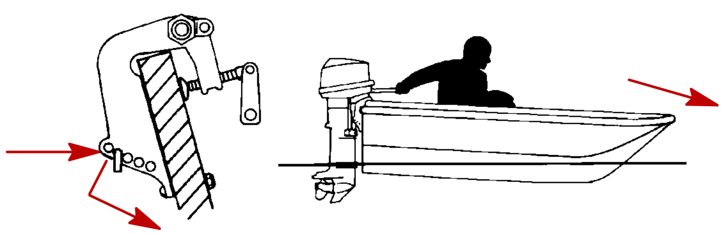
Flo-Torq II Drive Hub Propellers



a - Forward Thrust Hub
b - Replaceable Drive Sleeve
c - Propeller
d - Rear Thrust Hub
e - Propeller Nut – Tighten

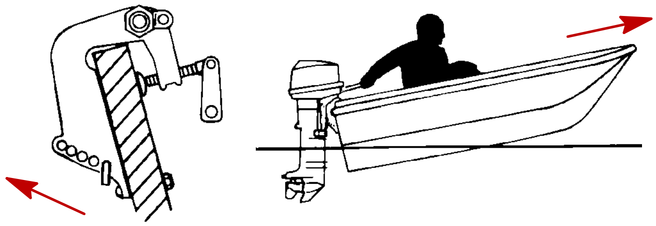
Tilt Pin Adjustment

Placing Tilt Pin in Lower Holes



1. Lower the bow.
2. Result in quicker planing off, especially with a heavy load or a stern heavy boat.
3. Generally improve the ride in choppy water.
4. Increase steering torque or pull to the right (with the normal right hand rotation propeller).
5. In excess, lower the bow of some boats to a point at which they begin to plow with their bow in the water while on plane. This can result in an unexpected turn in either direction called "bow steering" or "over-steering" if any turn is attempted or if a significant wave is encountered.

Placing Tilt Pin in Upper Holes



1. Lift the bow out of the water.
2. Generally increase top speed.
3. Increase clearance over submerged objects or a shallow bottom.
4. Increase steering torque or pull to the left at a normal installation height (with the normal right hand rotation propeller).
5. In excess, cause boat "porpoising" (bouncing) or propeller ventilation.

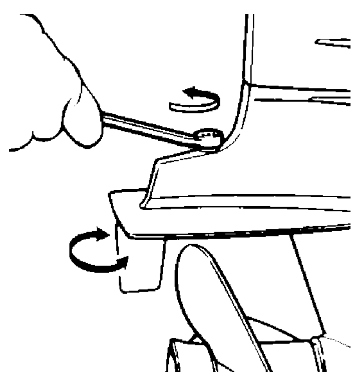
Trim Tab Adjustment

Propeller steering torque may cause boat to pull in one direction. This steering torque results from outboard not being adjusted so the propeller shaft is parallel to the water surface. The trim tab can help compensate for this steering torque and can be adjusted within limits to reduce any unequal steering effort.

NOTE: *Trim tab adjustment will have little effect reducing steering torque if the outboard is installed with the anti-ventilation plate approximately 2 inches (50mm) or more above the boat bottom.*

Operate boat at normal cruising speed, with the outboard set at the desired transom angle adjustment. Turn boat left and right and note the direction the boat turns more easily.

If adjustment is necessary, loosen trim tab bolt and make small adjustments at a time. If the boat turns more easily to the left, move the trailing edge of trim tab to the left. If the boat turns more easily to the right move the trailing edge of trim tab to the right. Retighten bolt and retest.



ELECTRICAL

Section 2A - Ignition

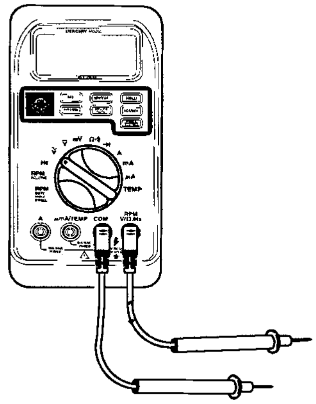
Table of Contents

Specifications

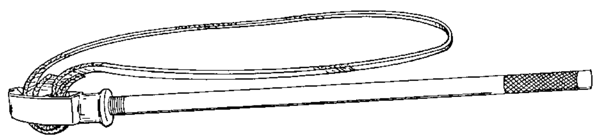
IGNITION SYSTEM **Readings taken @ 68°F (20°C).**	**Type**	Capacitor Discharge Ignition
	Spark Plug Type (NGK)	NGK BP8H-N-10
	Spark Plug Gap	0.040 in. (1.0 mm)
	Spark Plug Hex	18 mm
	Firing Order	1-2
	20 Jet 1994$^{1}/_{2}$ THRU 1998	
	20/25 1994$^{1}/_{2}$ THRU 1996	
	Electronic Spark Advance	
	Idle @ 750 ± 50 RPM (In Forward Gear)	4°±2°B.T.D.C (Not Adjustable)
	Fast Idle Speed	1400 RPM ± 250 RPM
	Maximum BTDC (Running)	25°±1 @5500 RPM
	Setup Timing	28°B.T.D.C. @ 3000 ± 200 R.P.M. (Set-up timing of 28°B.T.D.C. will be retarded to 25°B.T.D.C. @ 5500 R.P.M.)
	Stator High Speed Winding	100 – 180 Ω (RED – BLK)
	Stator Low Speed Winding	2900 – 3500 Ω (BLUE – BLACK)
	Diode Test	2800 – 3400 Ω (RED – BLUE)
	Ignition Coil Resistance:	
	Primary	0 Ω
	Secondary (w/o Boots)	850 – 1200 Ω
	20 Jet 1999 and Newer	
	20/25 1997/98 Models	
	Mechanical Spark Advance	
	Idle @ 750 ± 50 RPM (In Forward Gear)	6°±1°B.T.D.C
	Fast Idle Speed	1500 RPM ± 200 RPM
	Maximum BTDC (Running)	25°±1 @5500 RPM
	Stator High Speed Winding	120 - 180 Ω (BLK/WHT - GRD)
	Stator Low Speed Winding	3200 - 3800 Ω (BLK/YEL - GRD)
	Diode Test	3100 – 3700 Ω (BLK/YEL - BLK/WHT)
	Ignition Coil Resistance:	
	Primary	0.02 - 0.04 Ω
	Secondary (w/o Boots)	8000 - 11000 Ω
	Trigger	6500 - 8500 Ω

Special Tools

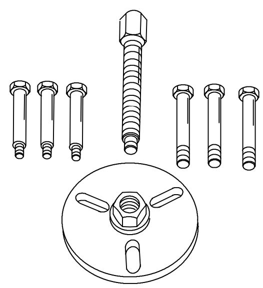
1. DMT 2000 Digital Tachometer Multi-meter P/N 91-854009A1



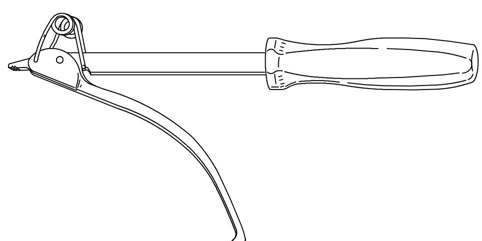
2. Flywheel Holder P/N 90-24937A1.



3. Flywheel Puller P/N 91-83164M.



4. Flywheel Holder 91-52344



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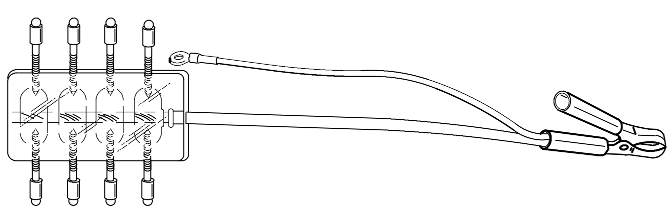
5. Spark Gap Board 91-850439



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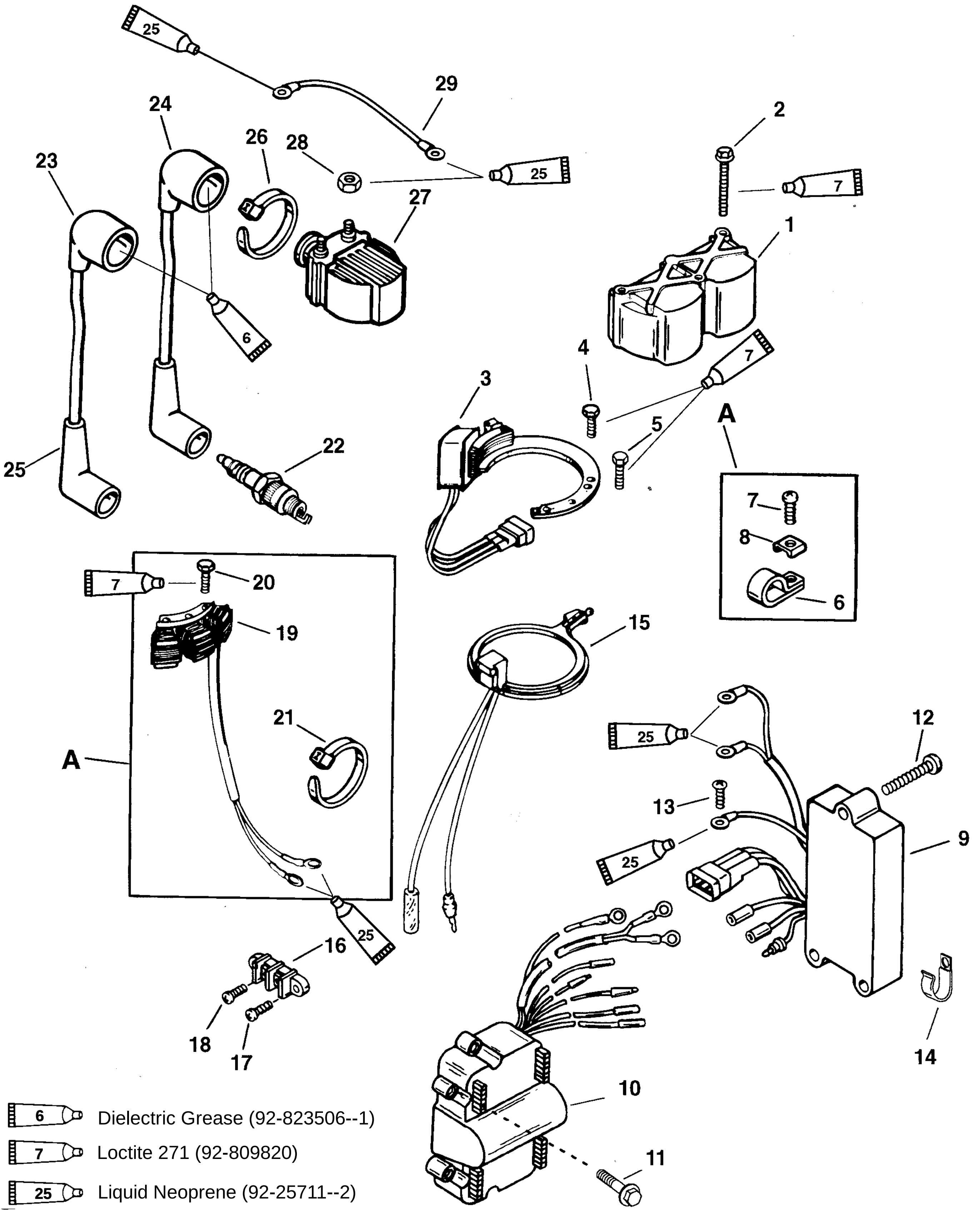
Ignition/Electrical Components



6 Dielectric Grease (92-823506--1)

7 Loctite 271 (92-809820)

25 Liquid Neoprene (92-25711--2)

A=ALTERNATOR VERSION ONLY

Ignition/Electrical Components

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	COVER–ignition coil			
2	3	SCREW–ignition coil cover (M5x.8x55)	80		9.0
3	1	STATOR ASSEMBLY **(20/25--USA-S/N-0G437999 & BELOW) (BEL-S/N-9926999 & BELOW)**			
	1	STATOR ASSEMBLY **(20/25--USA-S/N-0G438000 & UP) (BEL-S/N-9927000 & UP)**			
	1	STATOR ASSEMBLY **(JET 20)**			
4	2	SCREW–stator attaching (M5x.8x25)	80		9.0
5	1	SCREW–stator attaching (M5x12)	80		9.0
6	1	CLIP			
7	1	SCREW–clip to crankcase (#10-16x1/2 IN.)	Drive Tight		
8	1	C-WASHER–clip screw			
9	1	SWITCH BOX **(JET 20)(S# USA-0G590000 & UP)**			
	1	SWITCH BOX **(JET 20)(S#USA-0G589999 & BELOW)**			
	1	SWITCH BOX **(20/25--USA-S/N-0G437999 & BELOW) BEL-S/N-9926999 & BELOW)**			
10	1	SWITCH BOX **(20/25--USA-S/N-0G438000 thru 0G589999) (BEL-S/N-9927000 thru 9973099)**			
	1	SWITCH BOX **(20/25--USA-S/N-0G590000 & UP) (BEL-S/N-9973100 & UP)**			
11	2	SCREW (M5 x 20)			
12	3	SCREW (M5x.8x35 hex washer head)	Drive Tight		
13	1	SCREW–ground wire	Drive Tight		
14	1	CLIP			
15	1	TRIGGER ASSEMBLY			
16	1	TERMINAL BLOCK			
17	2	SCREW–terminal block (#10-16x5/8 IN.) **COMMERCIAL**			
18	2	SCREW–terminal block (#10-16x3/8 IN.)			
19	1	STATOR ASSEMBLY–auxiliary			
20	3	SCREW (M5x.8x30 hex head)	80		9.0
21	AR	STA-STRAP			
22	2	SPARK PLUG (NGK #BP8H-N-10)	240	20	27.1
	2	SPARK PLUG (NGK #BPZ8H-N-10) (CAN/BELG.)		20	27.1
23	1	HI-TENSION CABLE SET			
24	1	HI-TENSION CABLE (Part of Ref. #22)			
25	2	BOOT ASSEMBLY–spark plug			
26	AR	STA-STRAP			
27	2	IGNITION COIL ASSEMBLY			
28	4	NUT–coil terminal (1#10-32 Brass)	25		2.8
29	2	CABLE ASSEMBLY (Black)			

Ignition Description

The ignition system is an alternator driven capacitor discharge system. Major components of the ignition system are the flywheel, stator, trigger coil, switch box, 2 ignition coils and 2 spark plugs.

The flywheel has permanent magnets mounted in both the outer rim and the center hub.

The BLACK stator assembly is mounted below the flywheel and has a low speed (LS) and a high speed (HS) capacitor charging coil. Low speed coil provides primary voltage to the switch box from idle to approximately 2500 RPM. The high speed coil provides primary voltage from 2000 RPM to the maximum RPM the outboard is capable of achieving.

The RED stator assembly is mounted below the flywheel and has only one capacitor charging coil.

As the flywheel rotates, the magnets mounted in the flywheel outer rim pass the charging coils creating voltage. This voltage charges the capacitor located in the switch box.

As the flywheel continues to rotate, the magnets in the center hub pass the trigger coil creating AC voltage. This voltage turns on one of the two electronic switches (SCR) in the switch box. A positive voltage pulse turns on the SCR switch associated with cylinder #1; a negative voltage pulse turns on the SCR switch associated with cylinder #2.

The SCR switch discharges the stored capacitor voltage into the primary side of the respective ignition coil. The ignition coil multiplies this voltage to a value high enough to jump the spark plug gap – 32000 volts for standard coils; 40000 volts for high energy coils.

This sequence occurs once per engine revolution for each cylinder

Spark timing on electronically advanced models is controlled internally by the switch box with a fixed trigger.

Spark timing on mechanically advanced models is changed (advanced/retarded) by rotating the trigger coil which changes the trigger coil position in relation to the magnets in the center hub of the flywheel.

The stop switch (or ignition switch) shorts the output of the stator to ground to stop the engine on all models.

Electronic Spark Advance

20/25 OUTBOARDS SERIAL NUMBER:
USA 0G044027 THRU 0G437999
BELGIUM 09807909 THRU 09926999
20 JET OUTBOARDS
USA 0G044027 THRU 0G760299
BELGIUM 09807909 THRU 09016999

The spark timing is controlled by an electronic circuit within the engine switch box. The trigger assembly is positioned for maximum advance. (Refer to Set-Up Timing/Adjustment Procedure) The electronic timing feature of the switch box retards the timing on start up and at idle RPM. As the engine RPM increases the timing will advance. Maximum timing will occur at approximately 2500 RPM.

Mechanical Spark Advance

20/25 OUTBOARDS SERIAL NUMBER:
USA 0G438000 AND ABOVE
BELGIUM 09927000 AND ABOVE
20 JET OUTBOARDS SERIAL NUMBER
USA 0G760300 AND ABOVE
BELGIUM 09017000 AND ABOVE

The spark timing is changed (advanced/retarded) by rotating the trigger coil, which changes the trigger coil position in relation to the magnets in the center hub of the flywheel.

The stop switch (or ignition switch) shorts the output of the stator to ground to stop the engine.

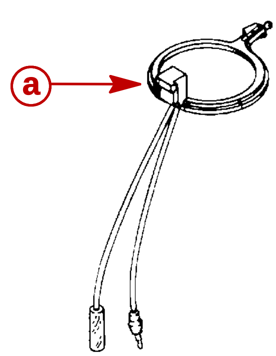
RPM Limiter

The 20 JET RED stator ignition module contains a RPM limiter circuit which interrupts one cylinder when RPM exceeds 6200 $\pm$100 RPM.

Ignition Component Description

Trigger Coil

A single wound coil located under the flywheel. The trigger is charged by the center hub flywheel magnet and sends a pulse voltage to an (SCR) switch located in the ignition switch
box.



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a - Trigger Coil

ELECTRONIC SPARK ADVANCE

The trigger is mounted in a fixed timing position.

MECHANICAL SPARK ADVANCE

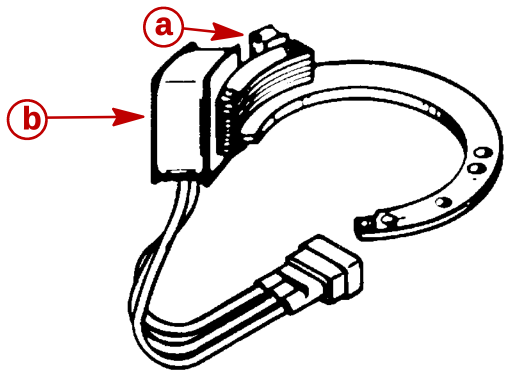
Spark timing is changed (advanced/retarded) by rotating the trigger coil, which changes the trigger coil position in relation to the magnets in the center hub of the flywheel.

Stator

The ignition stator located under the flywheel contains two stator windings. One low speed winding and one high speed winding.

As the outer flywheel magnets pass the stator windings, a current is produced that charges a capacitor in the ignition switch box.

Electronic Spark Advance Stator



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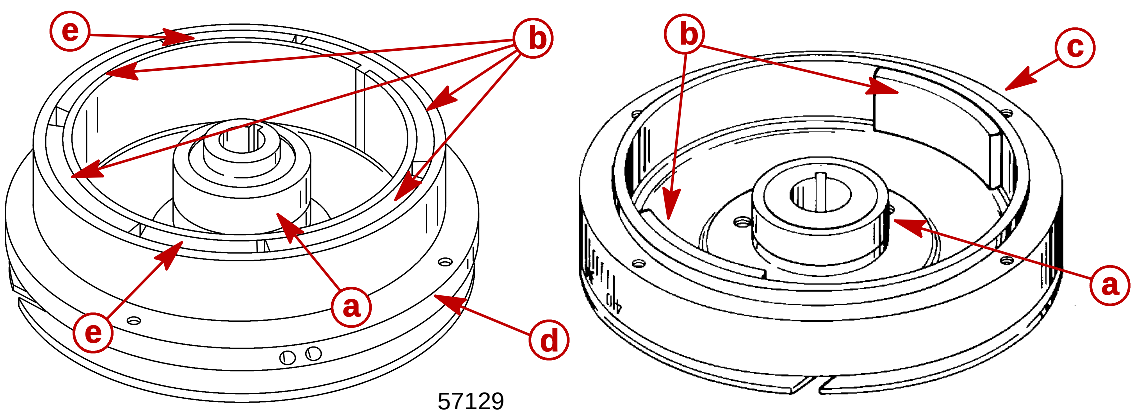
a - Low Speed Winding
b - High Speed Winding

Flywheel



57129

a - Center Hub Magnet
b - Outer Magnet
c - BLACK Stator Flywheel (2 Magnets)
d - RED Stator Flywheel (4 Magnets)
e - Spacers

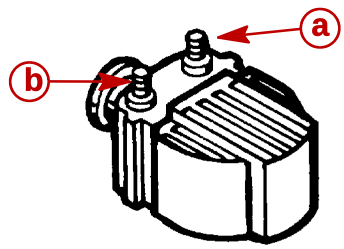
The flywheel assembly (BLACK stator) contains two outer magnets (8 Pole) (4 Pulse), and one center hub magnet. The outer magnets are needed for battery charge coil and ignition charge coils. The inner hub magnet is for trigger coil.

The flywheel assembly (RED stator) contains four outer magnets (10 Pole) (5 Pulse), and one center hub magnet. The outer magnets are needed for battery charge coil and ignition charge coils. The inner hub magnet is for trigger coil.

***NOTE:** Commercial and service flywheels will have 2 additional spacers and a retaining ring used only with the RED stator.*

Ignition Coil

The primary (+) side of the ignition coil receives voltage discharged from a capacitor in the ignition switch box. The voltage is multiplied by the coil until it can jump the spark plug gap. Ignition coil maximum output approximately 35000 volts.



52642

a - Positive (+) Primary Terminal
b - Negative Terminal

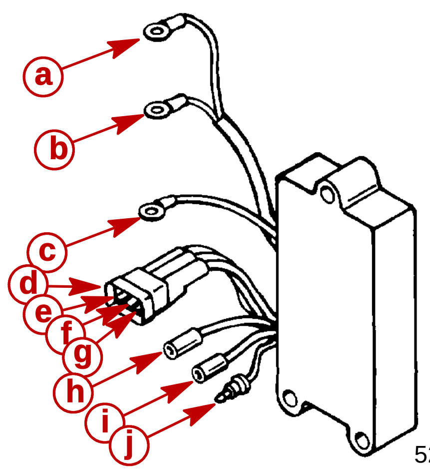
Ignition Switch Box

ELECTRONIC SPARK ADVANCE (BLACK STATOR)

The ignition switch box receives an AC current from the low and high speed stator assembly. This current is rectified and changed to a DC current where it will be stored in the internal capacitor. A voltage pulse from the trigger assembly (in firing order) turns on a respective SCR switch which discharges the capacitor stored voltage and sends it to the ignition coil.

The switch box contains an electrical circuit that controls the ignition spark timing. The switch box senses the engine R.P.M. by counting trigger pulses and adjusts the engine timing accordingly.

No idle timing adjustment is required. Refer to the Timing/Synchronizing/Adjusting section of this manual.

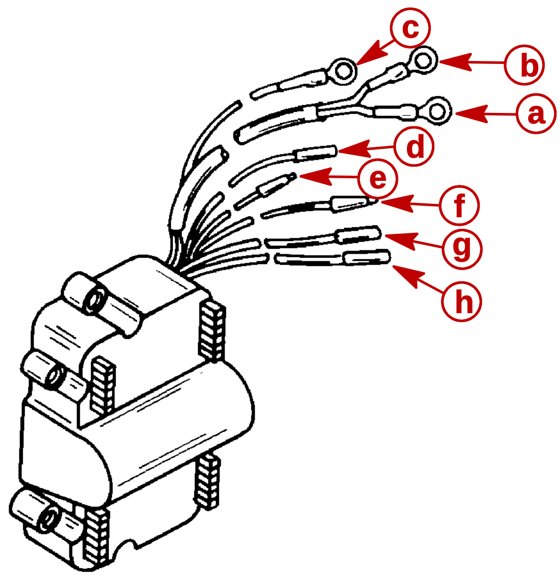


52642

a - #1 Coil Primary Lead (Green/Yellow)
b - #2 Coil Primary Lead (Green/White)
c - Ground Lead
d - Stator Connector
e - Stator Lead (RED) High Speed
f - Stator Ground Lead (BLACK)
g - Stator Lead (Blue) Low Speed
h - Engine Stop Lead (BLACK/YELLOW)
i - Trigger Lead (BROWN/WHITE)
j - Trigger Lead (BROWN/YELLOW)

MECHANICAL SPARK ADVANCE (BLACK STATOR)

The ignition switch box receives an AC current from the low and high speed stator assembly. This current is rectified and changed to a DC current where it will be stored in the internal capacitor. A voltage pulse from the trigger assembly (in firing order) turns on a respective SCR switch which discharges the capacitor stored voltage and sends it to the ignition coil.

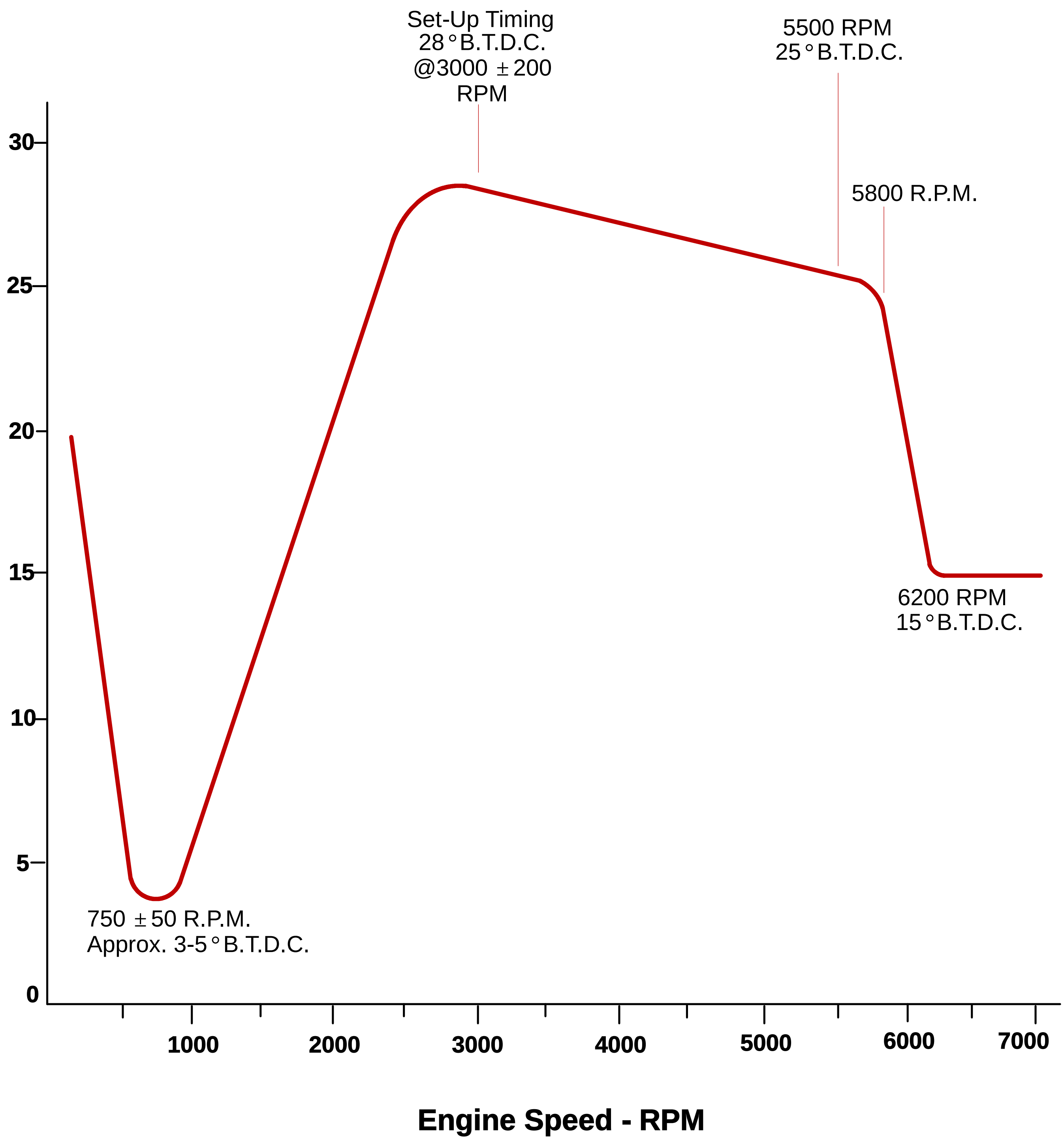


a - #1 Coil Primary Lead (Green/Yellow)
b - #2 Coil Primary Lead (Green/White)
c - Ground Lead
d - Engine Stop Lead (BLACK/YELLOW)
e - Trigger Lead (BROWN/YELLOW)
f - Stator Lead (BLACK/WHITE) High Speed
g - Trigger Lead (BROWN/WHITE)
h - Stator Lead(BLACK/YELLOW) Low Speed

MECHANICAL AND ELECTRONIC SPARK ADVANCE (RED STATOR)

The mechanical and electronic spark advance mechanism/circuitry operate the same with the RED stator as they do with the BLACK stator. The only difference is that the RED stator has only 1 charging coil whereas the BLACK stator has 2 charging coils; 1 high speed coil and 1 low speed coil.

Electronic Spark Advance



Ignition Test Procedures

Direct Voltage Adapter (DVA)

⚠ WARNING

DANGER – HIGH VOLTAGE/SHOCK HAZARD! Do not touch ignition components and/or metal test probes while engine is running and/or being "cranked". STAY CLEAR OF SPARK PLUG LEADS. To assure personal safety, each individual spark plug lead should be grounded to engine.

⚠ WARNING

When testing or servicing the ignition system, high voltage is present. DO NOT TOUCH OR DISCONNECT any ignition parts while engine is running, while key switch is on or while battery cables are connected.

⚠ CAUTION

Failure to comply with the following items may result in damage to the ignition system.

1. **DO NOT reverse battery cable connections. The battery negative cable is (-) ground.**
2. **DO NOT "spark" battery terminals with battery cable connections to check polarity.**
3. **DO NOT disconnect battery cables while engine is running.**
4. **DO NOT crank engine with CDI or Ignition Coils not grounded.**

⚠ CAUTION

To protect against meter and/or component damage, observe the following precautions:

- 400 VDC* test position (or higher) MUST BE used for all tests.
- INSURE the Positive (+) lead/terminal of DVA is connected to the Positive (+) receptacle of meter.
- DO NOT CHANGE meter selector switch position while engine is running and/or being "cranked".
- ALL COMPONENTS MUST BE GROUNDED during tests. Running or "cranking" engine with CDI or Ignition Coils ungrounded may damage components.

* If using a meter with a built-in DVA, the DVA/400 or DVA/500 VDC test position should be used.

NOTE: *Test leads are not supplied with the Direct Voltage Adapter. Use test leads supplied with multi meter.*

Test procedures and specifications are provided for **checking primary ignition voltage** while the engine is **running** and/or being **"cranked" with all harnesses connected.**

Ignition Troubleshooting

> **⚠ WARNING**
>
> **DANGER - HIGH VOLTAGE/SHOCK HAZARD! Do not touch ignition components and/or metal test probes while engine is running and/or being “cranked”. STAY CLEAR OF SPARK PLUG LEADS. To assure personal safety, each individual spark plug lead should be grounded to engine.**

> **⚠ WARNING**
>
> **When testing or servicing the ignition system, high voltage is present. DO NOT TOUCH OR DISCONNECT any ignition parts while engine is running.**

Ignition Diagnostic Procedures

TROUBLESHOOTING TIP: With engine running, use inductive timing light to check spark advance of each cylinder as throttle is opened and closed. If timing advances and retards smoothly on each cylinder, ignition system is MOST LIKELY functioning properly

IMPORTANT: If outboard appears to have an ignition system failure, it is recommended that before beginning in-depth troubleshooting:

a. Ensure that the engine is mechanically sound condition. (Fuel System, Cylinder Compression etc.).

b. Check all engine ground leads for loose or corroded connections.

c. Disconnect and reconnect ignition harness connectors to verify proper continuity.

PROBLEM	CORRECTION
1. No Spark or Weak Spark on Both Cylinders	No Spark – Trigger, Stator, Ignition Switch Box or Bad Ground Connection from Switch Box to Block Weak Spark – Stator
2. No Spark or Weak Spark on 1 Cylinder	Ignition Switch Box or Coil
3. Timing Fluctuates – Note: It is normal for timing to fluctuate 2°-3° @ Idle. – If engine RPM exceeds 5800, switch box will retard timing from 25° BTDC to 15° BTDC – If engine RPM drops below 600, idle stabilizer in switch box will advance timing to as high as 10° BTDC @ crank ing speed of 300 RPM.	Shorted Trigger Wire or Ignition Switch Box
4. Timing will not Advance – Note: If timing will not advance on only 1 cylinder, check wir- ing for shorted trigger wire	Defective Switch Box
5. Engine Misfires @ High RPM	Defective Coil Defective Switch Box

6. Engine Hard to Start when Cold	Defective Trigger Assembly Defective Ignition Switch Box
7. Engine Misfires @ Low RPM but Runs Smooth @ High RPM	Defective Harness or (loose connections) Defective Switch Box Defective Stator
8. Engine Starts Hard when Hot	Defective Switch Box or Trigger
9. Engine Occasionally Misfires	Replace Standard Spark Plug with Inductor Plug Bad Ground Connection from Switch Box to Block

Ignition Troubleshooting

Electronic Spark Advance

⚠ WARNING

DANGER – HIGH VOLTAGE/SHOCK HAZARD! Do not touch ignition components and/or metal test probes while engine is running and/or being "cranked". STAY CLEAR OF SPARK PLUG LEADS. To assure personal safety, each individual spark plug lead should be grounded to engine.

⚠ WARNING

When testing or servicing the ignition system, high voltage is present. DO NOT TOUCH OR DISCONNECT any ignition parts while engine is running, while key switch is on.

Tool: Multimeter/DVA Tester 91-99750A1

	Component Test	Selector Sw. Position	DVA Lead Red	DVA Lead Black	Voltage Reading(1) @300-3000 RPM	Voltage Reading @ 3000-4000 RPM
Test 1	Coil Primary	400 DVA*	Coil (+) Terminal	Coil (–) Terminal	160-250 (1)	200-280
Test 2	Sw. Box - Stop Circuit	400 DVA*	Black/Yellow Sw. Box Terminal	Ground	220-320	300-350
Test 3	Stator - Low Speed	400 DVA*	Blue Sw. (2) Box Terminal	Ground	220-320	300-350
Test 4	Stator - High Speed	400 DVA*	Red Sw. (2) Box Terminal	Ground	30-220	200-280

*If using a meter that requires a DVA adapter, place selector switch to the 400 VDC position.

(1)Readings may vary at cranking speed or at idle.

(2)Back probe the electrical connector in order to make connection.

Multimeter Ohm Checks

	Tested Part	Multimeter Wires	Connected To:	Meter Scale	Meter Reading
Test 5	Stator	RED BLACK	RED BLACK	R x 1 W	100 - 180
		RED BLACK	BLUE BLACK	R x 100 W	29 - 35
		RED BLACK	RED BLUE	R x 100 W	28 - 34
Test 6	Trigger	RED BLACK	BROWN/WHITE BROWN/YELLOW	R x 100 W	6.5 - 8.5

Test 7	Ignition Coils (“+”) wire disconnected)	RED BLACK	(+) Terminal (–) Terminal	R x 1 W	0
		RED BLACK	Spark Plug Tower (+) Terminal	R x 100 W	8.5 - 12

NOTE: *Copper is an excellent conductor, however resistance may notably vary between low and high temperature. Therefore, reasonable differences can be accepted between resistance readings and specifications.*
The above readings are for a cold (room temperature) engine. Resistance will increase if the engine is warm.

Ignition Troubleshooting

Mechanical Spark Advance

TOOL : MULTIMETER/DVA TESTER 91-99750

Tested Part	Multimeter Wires	Connected To	Scale	Resistance (ohms)
Stator (BLACK/YELLOW and BLACK/WHITE wires disconnected from switch boxes)	RED BLACK	BLACK/WHITE GROUND	R x 1	120 - 180
	RED BLACK	BLACK/YELLOW GROUND	R x 100	32 - 38
	RED BLACK	BLACK/YELLOW BLACK/WHITE	R x 100	31 - 37
Trigger (BROWN/YELLOW and BROWN wires disconnected from switch boxes)	RED BLACK	BROWN/YELLOW BROWN	R x 100	6.5 - 8.5

Tested Part	Multimeter	Connected To	Scale	Resistance (ohms)
Ignition Coils (all wires disconnected)	RED BLACK	+ Terminal – Terminal	R x 1	0.02 - 0.04
	RED BLACK	Spark Plug Tower – Terminal	R x 1000	8 - 11

Tested Part	Multimeter Wires	Connected To	Selector Position	Reading At 300 - 1000 RPM	Reading At 1000 - 4000 RPM
Switch Box Primary Coil	RED BLACK	– Terminal + Terminal	400 VDC	125 -260	200 - 360
Switch Box Stop Circuit Stator Low Speed	RED BLACK	GROUND BLACK/YELLOW	400 VDC	150 - 300	250 - 360
Stator High Speed	RED BLACK	GROUND BLACK/WHITE	400 VDC	10 - 75	50 - 300

Ignition Troubleshooting (RED Stator)

TOOL : MULTIMETER/DVA TESTER 91-99750

Tested Part	Multimeter Wires	Connected To	Scale	Resistance (ohms)
Stator (GREEN/ WHITE and WHITE/GREEN wires disconnected from switch boxes)	RED BLACK	GREEN/WHITE WHITE/GREEN	R x 1	370 - 445
Trigger (BROWN/ YELLOW and BROWN/WHITE wires disconnected from switch boxes)	RED BLACK	BROWN/YELLOW BROWN/WHITE	R x 100	6.5 - 8.5

Tested Part	Multimeter	Connected To	Scale	Resistance (ohms)
Ignition Coils (all wires dis-connected)	RED BLACK	+ Terminal – Terminal	R x 1	0.02 - 0.04
	RED BLACK	Spark Plug Tower – Terminal	R x 1000	8 - 11

Tested Part	Multimeter Wires	Connected To	Selector Position	Reading At 300 - 1000 RPM	Reading At 1000 - 4000 RPM
Switch Box Primary Coil	RED BLACK	– Terminal + Terminal	400 VDC	125 - 320	200 - 320
Switch Box Stop Circuit	RED BLACK	BLACK/YELLOW GROUND	400 VDC	150 - 330	250 - 330
Stator Voltage	RED BLACK	GREEN/WHITE GROUND	400 VDC	150 - 330	250 - 330
	RED BLACK	WHITE/GREEN GROUND	400 VDC	150 - 330	250 - 330

NOTE: *Copper is an excellent conductor, but resistance may notably vary between low and high temperature. Therefore, reasonable differences can be accepted between resistance readings and specifications.*

ELECTRICAL

Section 2B - Battery Charging and Starting Systems

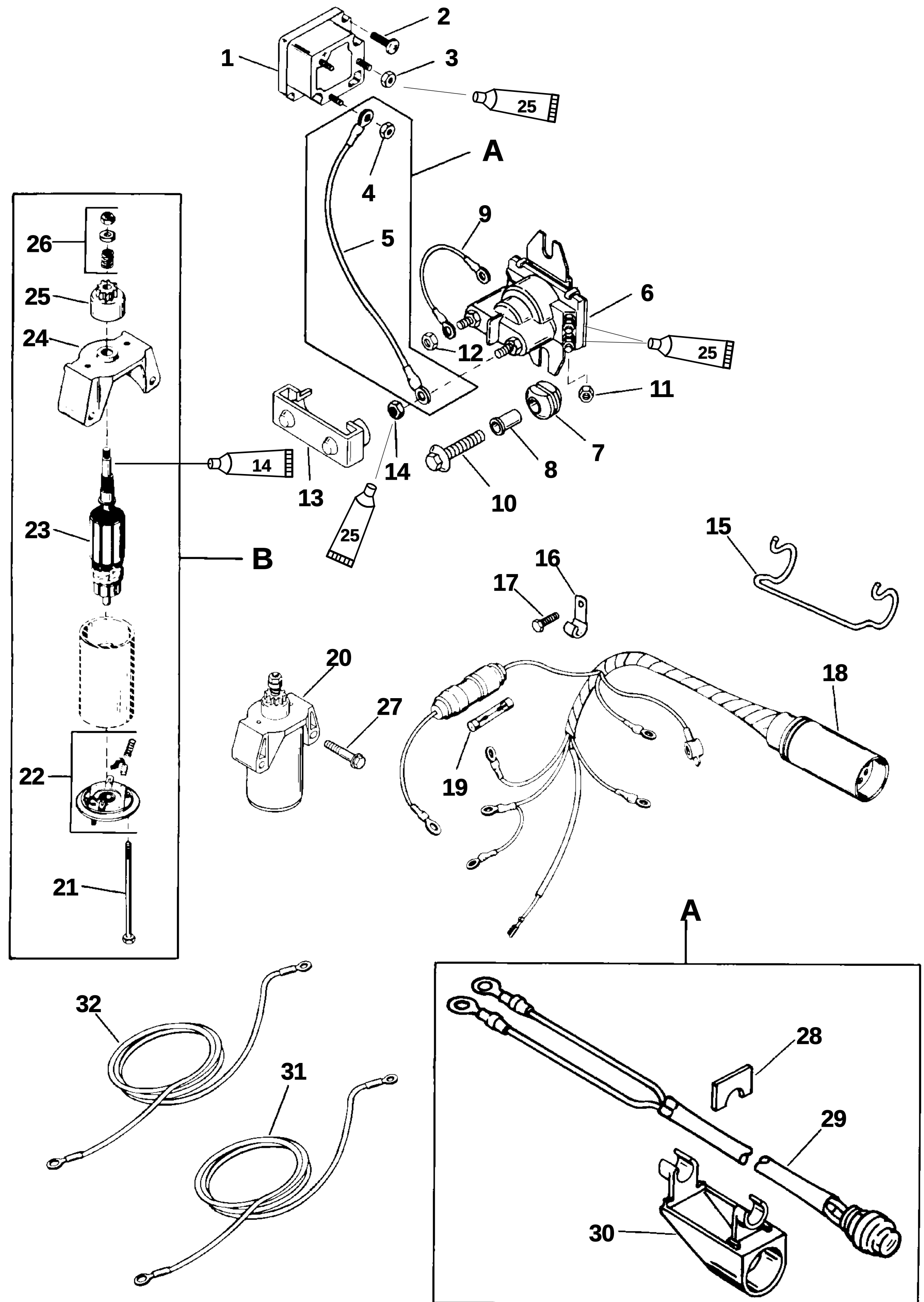
2 B

Table of Contents

Specifications

BATTERY	**Battery Rating**	465 Marine Cranking Amps (MCA) or 350 Cold Cranking Amps (CCA)
CHARGING SYSTEM	**Alternator Output** **BLACK Stator - 2 Magnet Flywheel (8 Pole – 4 Pulse)** **RED Stator - 4 Magnet Flywheel (10 Pole – 5 Pulse))**	 4 Amp. (48 Watt) @ 6000 RPM 6 amp (72 Watt) @ 6000 RPM
STARTING SYSTEM	**Manual Start** **Electric Start** **Ampere Draw (Under Load)** **(No Load)**	Recoil 12 Volt 55 amperes 15 Amperes

Electric Start Components



14 2 Cycle Outboard Oil (92-13249A24)

25 Liquid Neoprene (92-25711--2)

A=LOCAL ELECTRIC ONLY B=SERVICE ONLY

Electric Start Components

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
1	1	RECTIFIER			
2	2	SCREW (#10-16x5/8 IN.)	Drive Tight		
3	2	NUT (#10-32 Brass)	25		2.8
4	1	NUT (#10-32 Brass)	25		2.8
5	1	CABLE ASSEMBLY (Red)			
6	1	STARTER SOLENOID ASSEMBLY			
7	2	BUSHING			
8	2	GROMMET			
9	1	WIRE ASSEMBLY-yellow			
10	2	SCREW (M6x1x25 hex head cap)	40		4.5
11	2	NUT (#8-32 Brass)	25		2.8
12	1	NUT (1/4-20)	30		3.4
13	1	INSULATOR-solenoid			
14	1	NUT (1/4-20)	30		3.4
15	1	RETAINER-harness connector			
16	1	J-CLIP			
17	1	SCREW (M6x30 hex head cap)	140	12.0	15.8
18	1	WIRING HARNESS ASSEMBLY-engine			
19	1	FUSE			
20	1	STARTER MOTOR ASSEMBLY			
21	1	THRU BOLT			
22	1	END CAP (W/BRUSHES)			
23	1	ARMATURE			
24	1	DRIVE CAP			
25	1	DRIVE			
26	1	DRIVE KIT			
27	2	SCREW (M8x1.25x55 hex washer)	220	18.0	24.8
28	1	CLIP			
29	1	START SWITCH ASSEMBLY			
30	1	HOUSING-switch			
31	1	BATTERY WIRE ASSEMBLY-black			
32	1	BATTERY WIRE ASSEMBLY-red			

Battery

Precautions

When charging batteries, an explosive gas mixture forms in each cell. A portion of this gas escapes thru holes in vent plugs and may form an explosive atmosphere around battery if ventilation is poor. This explosive gas may remain in or around battery for several hours after it has been charged. Sparks or flames can ignite this gas and cause an internal explosion which may shatter the battery.

The following precautions should be observed to prevent an explosion.

1. DO NOT smoke near batteries being charged or which have been charged very recently.
2. DO NOT break live circuits at terminals of batteries because a spark usually occurs at the point where a live circuit is broken. Always be careful when connecting or disconnecting cable clamps on chargers. Poor connections are a common cause of electrical arcs which cause explosions.
3. DO NOT reverse polarity of battery cables on battery terminals.

CAUTION

If battery acid comes into contact with skin or eyes, wash skin immediately with a mild soap. Flush eyes with water immediately and see a doctor.

Recommended Battery

A 12 volt battery with a "Marine Cranking Amperage" rating minimum of 465 amperes or or a "Cold Cranking Amperage" of 400.

Operating Engine Without Battery

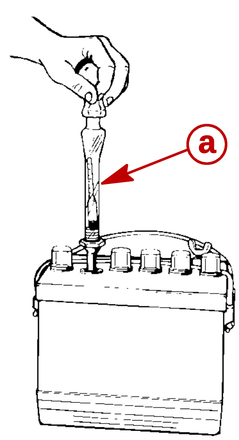
If desired (or in an emergency), engines equipped with an alternator can be started and operated without a battery (either disconnected or removed) if "**WARNING**", below, is followed.

WARNING

Before operating engine with battery leads disconnected from battery, disconnect stator leads (Yellow) from rectifier. Insulate (tape) stator lead ring terminals.

Specific Gravity Readings

Use a hydrometer to measure specific gravity of electrolyte in each cell.



a - Hydrometer

Hydrometer measures percentage of sulfuric acid in battery electrolyte in terms of specific gravity. As a battery drops from a charged to a discharged condition, acid leaves the solution and chemically combines with the plates, causing a decrease in specific gravity of electrolyte. An indication of concentration of electrolyte is obtained with a hydrometer.

When using a hydrometer, observe the following points:

1. Hydrometer must be clean (inside and out) to insure an accurate reading.
2. Never take hydrometer readings immediately after water has been added. Water must be thoroughly mixed with electrolyte by charging for at least 15 minutes at a rate high enough to cause vigorous gassing.
3. If hydrometer has built-in thermometer, draw liquid in several times to ensure correct temperature before taking reading.
4. Hold hydrometer vertically and draw in just enough liquid from battery cell so that float is free-floating. Hold hydrometer at eye level so that float is vertical and free of outer tube, then take reading at surface of liquid. Disregard curvature where liquid rises against float stem due to capillary action.
5. Avoid dropping electrolyte on boat or clothing, as it is extremely corrosive. Wash off immediately with baking soda solution.

Specific gravity of electrolyte varies not only with percentage of acid in liquid but also with temperature.As temperature drops, electrolyte contracts, so that specific gravity increases. Unless these variations in specific gravity are taken into account, specific gravity obtained by hydrometer may not give a true indication of concentration of acid in electrolyte.

A fully charged battery will have a specific gravity reading of approximately 1.270 at an electrolyte temperature of 80 °F (27 °C). If electrolyte temperature is above or below 80 ° F, additions or subtractions must be made in order to obtain a hydrometer reading corrected to 80 °F standard. For every 10 °F (3.3 °C) above 80 °F, add 4 specific gravity points (.004) to hydrometer reading. Example: A hydrometer reading of 1.260 at 110 °F (43 °C) would be 1.272 corrected to 80 °F, indicating a fully charged battery.

For every 10 °below 80 °F, subtract 4 points (.004) from the reading. Example: A hydrometer reading of 1.272 at 0 °F (-18 °C) would be 1.240 corrected to 80 °F, indicating a partially charged battery.

SPECIFIC GRAVITY CELL COMPARISON TEST

This test may be used when an instrumental tester is not available. To perform this test, measure specific gravity of each cell, regardless of state of charge, and interpret results as follows: If specific gravity readings show a difference between highest and lowest cell of .050 (50 points) or more, battery is defective and should be replaced.

Electrolyte Level

Check electrolyte level in battery regularly. A battery in use in hot weather should be checked more frequently because of more rapid loss of water. If electrolyte level is found to be low, then distilled water should be added to each cell until liquid level rises approximately 3/16 " (4.8mm) over plate. DO NOT OVERFILL, because this will cause loss of electrolyte and result in poor performance, short life and excessive corrosion.

⚠ CAUTION

During service, only distilled water should be added to the battery, not electrolyte.

Charging A Discharged Battery

The following basic rules apply to any battery charging situation:

1. Any battery may be charged at any rate (in amperes) as long as spilling of electrolyte (from violent gassing) does not occur and as long as electrolyte temperature does not exceed 125°F (52°C). If spewing of electrolyte occurs, or if electrolyte temperature exceeds 125°F, charging rate (in amperes) must be reduced or temporarily halted to avoid damage to the battery.
2. Battery is fully charged when, over a 2-hour period at a low charging rate (in amperes), all cells are gassing freely (not spewing liquid electrolyte), and no change in specific gravity occurs. Full charge specific gravity is 1.260-1.275, corrected for electrolyte temperature with electrolyte level at 3/16" (4.8mm) over plate. For most satisfactory charging, lower charging rates in amperes are recommended.
3. If, after prolonged charging, specific gravity of at least 1.230 on all cells cannot be reached, battery is not in optimum condition and will not provide optimum performance; however, it may continue to provide additional service, if it has performed satisfactorily in the past.
4. To check battery voltage while cranking engine with electric starter motor, place RED (+) lead of tester on POSITIVE (+) battery terminal and BLACK (–) lead of tester on NEGATIVE (–) battery terminal. If the voltage drops below 9-1/2 volts while cranking, the battery is weak and should be recharged or replaced.

Winter Storage of Batteries

Battery companies are not responsible for battery damage, either in winter storage or in dealer stock, if the following instructions are not observed:

1. Remove battery from its installation as soon as possible and remove all grease, sulfate and dirt from top surface by running water over top of battery. Be sure, however, that vent caps are tight beforehand and blow off all excess water thoroughly with compressed air. Check water level, making sure that plates are covered.
2. When adding distilled water to battery, be extremely careful not to fill more than 3/16" (4.8mm) over plate inside battery. Battery solution or electrolyte expands from heat caused by charging. Overfilling battery will cause electrolyte to overflow (if filled beyond 3/16" over plate).
3. Grease terminal bolts well with Quicksilver 2-4-C Marine Lubricant, and store battery in COOL-DRY place. Remove battery from storage every 30-45 days, check water level (add water if necessary), and put on charge for 5 or 6 hours at 6 amperes. DO NOT FAST CHARGE.
4. If specific gravity drops below 1.240, check battery for reason, and then recharge. When gravity reaches 1.260, discontinue charging. To check specific gravity, use a hydrometer, which can be purchased locally.
5. Repeat preceding charging procedure every 30-45 days, as long as battery is in storage. When ready to place battery back in service, remove excess grease from terminals (a small amount is desirable on terminals at all times), recharge again as necessary and re-install battery.

⚠ WARNING

Hydrogen and oxygen gases are produced during normal battery operation or charging. Sparks or flame can cause this mixture to ignite and explode, if they are brought near the battery. Sulfuric acid in battery can cause serious burns, if spilled on skin or in eyes. Flush or wash away immediately with clear water.

Voltage Regulator Test

Lamps Burn Out When Engine RPM is Increased

The voltage regulator is defective. Replace regulator.

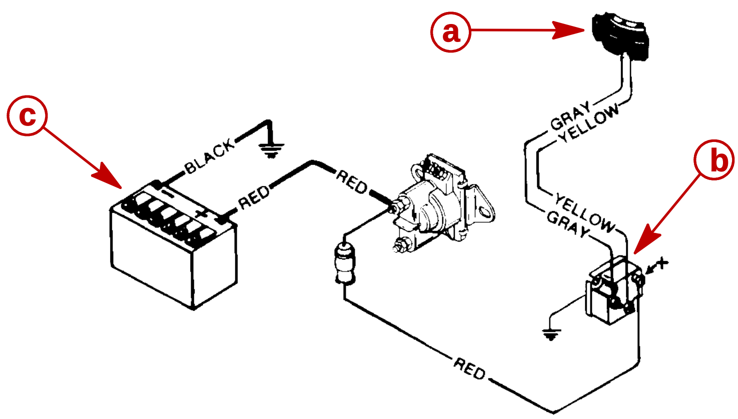
Lamps Burn Dim at Wide-Open-Throttle

1. Run engine at mid-range (approximately 3000 RPM) with 3 number 94 lamps connected to voltage regulator output leads. Note lamp brightness.
2. Disconnect the leads at one terminal of regulator. Connect the leads together using a screw and nut. Isolate (tape) connection.
3. Run engine at mid-range (approximately 3000 RPM) and note lamp brightness. If lamps are considerably brighter than with leads connected to regulator, the regulator is defective. If lamps are NOT considerably brighter, check the alternator (refer to **"Alternator Test"** , following.

Battery Charging System

Description

The battery charging system components are the alternator, rectifier and battery. Alternating current (generated in alternator coils) flows to the rectifier which changes AC current to direct current (DC) for charging the battery.



a - Alternator
b - Rectifier
c - Battery

The charging system may be damaged by:

a. Reversed battery cables.

b. Running the engine with battery cables disconnected and alternator leads connected to rectifier.

c. An open circuit – such as a broken wire or loose connection.

Alternator Amperes Output

Amperage output can be measured by installing a 10 ampere (minimum) amp meter in series between the rectifier and the battery or by clamping an inductive type amp meter (10 amp minimum) over the RED output lead from the rectifier to the battery.

BLACK Stator (2 Magnet Flywheel)

RPM	AMPERES (Approximate)
Idle	0
1000	0
2000	.5
3000	2.2
4000	3.1
5000	3.8
6000	4.0

RED Stator (4 Magnet Flywheel)

RPM	AMPERES (Approximate)
Idle	0
1000	0.8
2000	4.1
3000	5.3
4000	5.8
5000	6.1
6000	6.3

Battery Charging System Troubleshooting

A fault in the battery charging system usually will cause the battery to become undercharged. Check battery electrolyte level, and charge battery. See "**Electrolyte Level**", and "**Charging a Discharged Battery**".

If battery will NOT accept a satisfactory charge, replace battery.

If battery accepts a satisfactory charge, determine the cause of the charging system problem as follows.

1. Check for correct battery polarity [RED cable to POSITIVE (+) battery terminal]. If polarity was incorrect, check for damaged rectifier. See "RECTIFIER TEST".
2. Check for loose or corroded battery connections.
3. Visually inspect wiring between stator and battery for cuts, chafing; and disconnected, loose or corroded connection.
4. Excessive electrical load (from too many accessories) will cause battery to run down.

If visual inspection determines that battery connections and wiring are OK, perform the following stator and rectifier tests.

Alternator Test

***NOTE:** Alternator can be tested without removing from engine. DC resistance of these windings generally is less than 1 ohm. A reading that resembles a short is acceptable.*

1. Disconnect GRAY and YELLOW alternator leads from terminals on either rectifier, voltage regulator or isolator block.
2. Use an ohmmeter and perform tests as shown in following chart.
3. If meter readings are other than specified, replace alternator assembly.

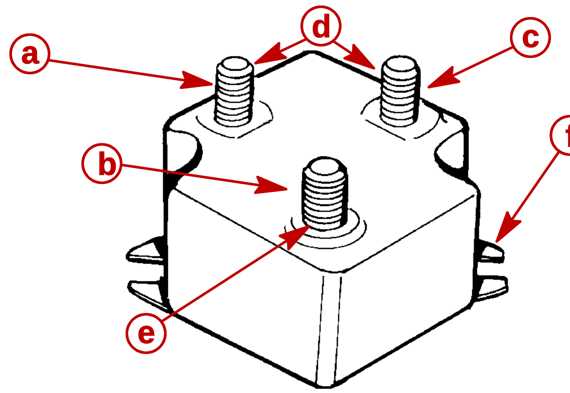
Test Leads	Resistance	Scale
RED to YELLOW BLACK to GRAY	0.65	R x 1
RED to either GRAY or YELLOW BLACK to GROUND	NO CONTINUITY	R x 1000

Rectifier Test

⚠ WARNING

Disconnect battery leads from battery before testing rectifier.

***NOTE:** *Rectifier can be tested without removing from engine.*



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Rectifier Test (continued)

- Connect RED meter lead to ground, BLACK lead alternately to terminals “a” and “c”.
  - Continuity Indicated
    Connect BLACK meter lead to ground, RED lead alternately to terminals “a” and “c”.
    - No Continuity Indicated
      Connect BLACK meter lead to terminal “b”, RED lead alternately to terminals “a” and “c”.
      - Continuity Indicated
        Connect RED meter lead to terminal “b”, BLACK lead alternately to terminals “a” and “c”.
        - No Continuity Indicated. Rectifier tests O.K.
        - Continuity Indicated. Replace Rectifier.
      - No Continuity Indicated. Replace Rectifier.
    - Continuity Indicated. Replace Rectifier.
  - No Continuity Indicated
    Connect BLACK meter lead to ground, RED lead alternately to terminals “a” and “c”.
    - No Continuity Indicated. Replace Rectifier.
    - Continuity Indicated
      Connect BLACK meter lead to terminal “b”, RED lead alternately to terminals “a” and “c”.
      - Continuity Indicated. Replace Rectifier.
      - No Continuity Indicated
        Connect RED meter lead to terminal “b”, BLACK lead alternately to terminals “a” and “c”.
        - No Continuity Indicated. Replace Rectifier.
        - Continuity Indicated. Rectifier Tests O.K.

Starting System

STARTER MOTOR AMPERES DRAW

STARTER MOTOR PART NO.	NO LOAD AMP. DRAW	NORMAL AMP. DRAW
50-90983A1	15 AMPS	55 AMPS
Starter Motor Teeth	10	

STARTING SYSTEM COMPONENTS

The starting system consists of the following components.

1. Battery
2. Starter Solenoid
3. Neutral Start Switch
4. Starter Motor
5. Ignition Switch

Description

The function of the starting system is to crank the engine. The battery supplies electrical energy to crank the starter motor. When the ignition switch is turned to "START" position, the starter solenoid is activated and completes the starting circuit between the battery and starter.

The neutral start switch opens the start circuit when the shift control lever is not in neutral. This prevents accidental starting when engine is in gear.

⚠ CAUTION

The starter motor may be damaged if operated continuously. DO NOT operate continuously for more than 30 seconds. Allow a 2 minute cooling period between starting attempts.

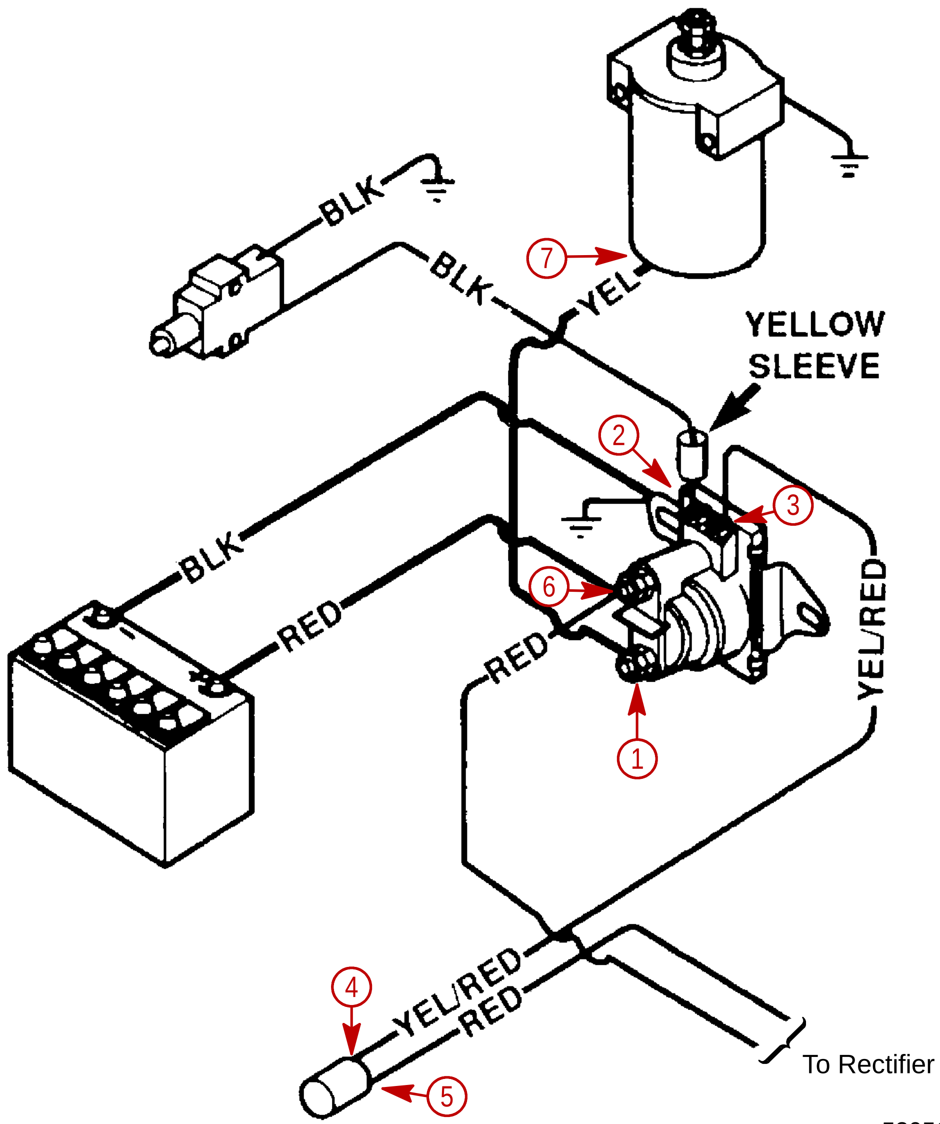
Troubleshooting the Starting Circuit

Before beginning the starting circuit troubleshooting flow chart, following, check first for the following conditions:

1. Make sure that battery is fully charged.
2. Check that control lever is in "NEUTRAL" position.
3. Check terminals for corrosion and loose connections.
4. Check cables and wiring for frayed and worn insulation.
5. Check in-line fuse in RED wire; see diagram SEC 2D.

The following "STARTING CIRCUIT TROUBLESHOOTING FLOW CHART" is designed as an aid to troubleshooting the starting circuit. This flow chart will accurately locate any existing malfunction. Location of "TEST POINTS" (called out in the chart) are numbered in diagram below.

IMPORTANT: Remote Control Electric Start Models have a 20 Ampere fuse located under the cowl next to the starter solenoid. This fuse protects the remote control harness. If this fuse is open, the starter will be inoperative. The cause of the blown fuse (a short) should be found and corrected.



Starting Circuit Troubleshooting Flow Chart

Starter Motor Does Not Turn

SAFETY WARNING: Disconnect BLACK (w/YELLOW sleeve) cable from starter solenoid test point 1 BEFORE making tests to prevent unexpected engine cranking.

TEST 1
Use an ohmmeter (R x 1 scale) and connect meter leads between NEGATIVE (-) battery post and common powerhead ground.

No Continuity Indicated
There is an open circuit in the BLACK NEGATIVE (-) battery cable between the NEGATIVE (-) battery post and the powerhead.
- Check cable for loose or corroded connections.
- Check cable for open.

Continuity Indicated
Proceed to TEST 2, on next page

** Battery Voltage*

TEST 2
a. Connect voltmeter between common engine ground and Test Point 2.
b. Push start switch.

No voltage reading; proceed to TEST 3.

TEST 3
a. Connect voltmeter between common engine ground and Test Point 3.
b. Push Start Switch.

12 Volt Reading*
Check BLACK ground wire for poor connection or open circuit. Reconnect ground wire to starter solenoid; proceed to TEST 7.

Electric Start Tiller Handle Model
Neutral start switch on lower engine cowl is open or BLACK or WHITE switch leads are disconnected or damaged. Proceed to TEST 7.

No voltage reading; proceed to TEST 4.

12 Volt Reading
Defective starter solenoid.

TEST 4
a. Connect voltmeter between common engine ground and Test Point 4.
b. Push Start Switch.

No voltage reading; proceed to TEST 5.

12 Volt Reading*
Neutral start switch is open, or YELLOW/RED wire is open between Test Points 4 and 3.

TEST 5
Connect voltmeter between common engine ground and Test Point 5.

No voltage reading; proceed to TEST 6.

12 Volt Reading*
Defective ignition switch.

TEST 6
Connect voltmeter between common engine ground and Test Point 6.

No voltage reading; check RED wire between battery (+) positive terminal and Test Point 6.

12 Volt Reading*
Check fuse in RED wire between test points 5 and 6.
Check for open RED wire between test points 5 and 6.

TEST 7
a. Connect voltmeter between common engine ground and Test Point 1.
b. Push Start Switch.

No voltage reading; Defective starter solenoid.

12 Volt Reading*
Should hear solenoid click; proceed to TEST 8.

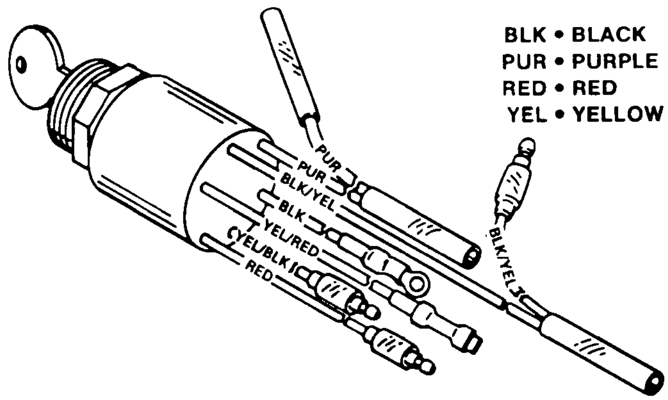
TEST 8
a. Reconnect BLACK (starter motor) cable to starter solenoid Test Point 1.
b. Connect voltmeter between common engine ground and Test Point 7
c. Push Start Switch.

No voltage reading; check BLACK cable for poor connection or open circuit.

12 Volt Reading*
Check BLACK ground cable at starter for loose or corroded connection, or open circuit. If cable is O.K., check starter motor.

Commander 2000 Key Switch Test

1. Disconnect remote control wiring harness and instrument panel connector.
2. Set ohmmeter on R x 1 scale for the following tests:



23894

KEY POSITION	BLK	BLK/YEL	RED	YEL/RED	PUR	YEL/BLK
OFF	O	O				
RUN			O	—	O	
START			O	O		
				O	O	
			O	—	—	
CHOKE*			O	—	—	O
			O	—	O	
					O	O

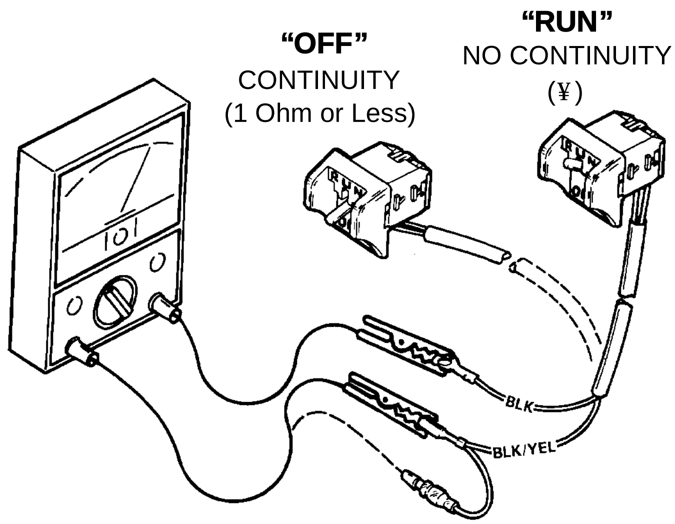
NOTE: Key switch must be positioned to "RUN" or "START" and key pushed in to actuate choke for this test.

3. If meter readings are other than specified in the preceding tests, verify that switch and not wiring is faulty. If wiring checks ok, replace switch.

Emergency Stop Switch (Lanyard Type)

IMPORTANT: Refer to Section 2D "Wiring Diagrams" for wiring connections.

1. Disconnect emergency stop switch leads from engine wiring.
2. Use an ohmmeter and perform the following tests.



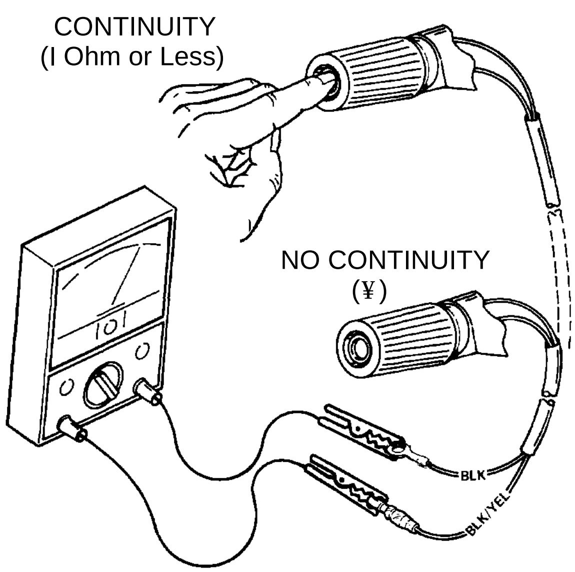
23421

3. If meter readings are other than specified, replace emergency stop switch.

Push Button Stop Switch

IMPORTANT: Refer to Section 2D "Wiring Diagrams" for wiring connections.

1. Disconnect push button stop switch leads from engine wiring.
2. Use an ohmmeter and perform the following tests.



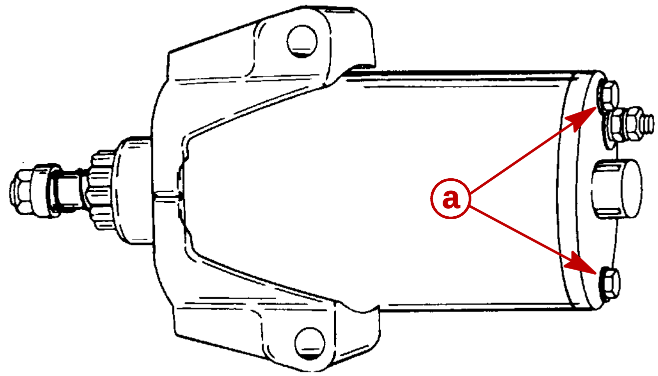
23421

3. If meter readings are other than specified, replace push button stop switch.

Starter Motor

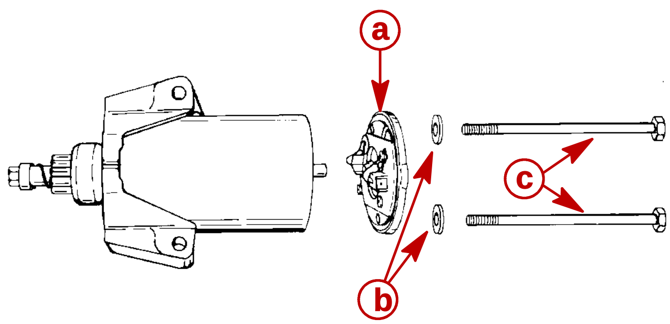
Disassembly

1. Remove 2 thru bolts from starter.



a - Bolts

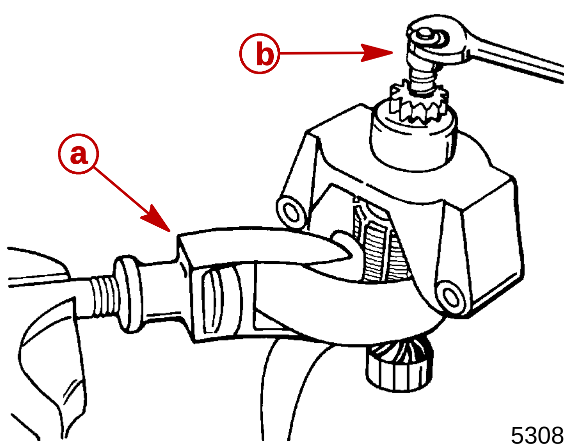
2. Lightly tap on end of shaft and lower end cap with rubber mallet. Do not loose brush springs.



53235

a - Lower End Cap
b - Washers
c - Bolts

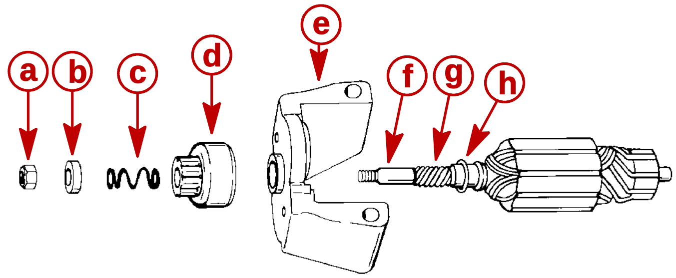
3. Tap on drive end cap to loosen. Remove end cap and armature from starter housing.
4. If removal of parts that are installed on armature is necessary, hold armature with Strap Wrench (91-24937A1) and remove locknut (and discard) from end of shaft.



53081

a - Strap Wrench (91-24937A1)
b - Locknut (discard)

5. Remove parts from shaft.



53228

a - Locknut
b - Spacer
c - Spring
d - Drive Assembly
e - Drive End Cap
f - Armature Shaft
g - Helix Threads
h - Washer

Cleaning and Inspection

1. If brushes are pitted, chipped or worn to less than 3/16 in. (4.8mm), replace brushes.

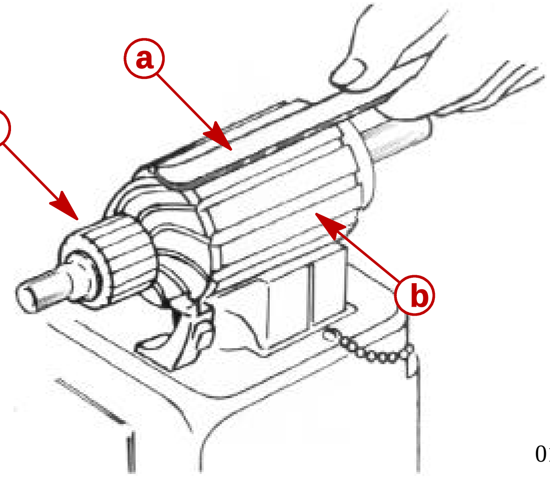
IMPORTANT: DO NOT clean the starter drive assembly or armature shaft while starter motor is installed on outboard. The cleaning solution will drain dirt into motor housing.

2. If the motor drive assembly does not fully engage with flywheel, the drive assembly may be binding on the helix threads on the armature shaft due to dirt or wear. Locate cause of binding and correct before reassembling.
3. Clean drive components with cleaning solution and inspect parts for wear.
4. Clean commutator with No. 00 sandpaper. Remove any oil from commutator. If commutator surface is pitted , rough or worn unevenly, resurface on a lathe.
5. Resurface commutator on a lathe as follows:
   a. Use a lathe to turn down the commutator surface. DO NOT turn down the commutator surface excessively.
   b. Clean copper particles from slots between commutator bars.
   c. Sand the commutator lightly with No. 00 sand paper to remove burrs. Thoroughly clean the armature after resurfacing and sanding.

Testing Motor Armature

TESTING ARMATURE FOR SHORTS

1. Place armature in a growler and switch growler on.
2. Hold hack saw blade over armature core while rotating armature.
3. If saw blade vibrates, armature is shorted. Retest after cleaning between commutator bars. If saw blade still vibrates, replace armature.

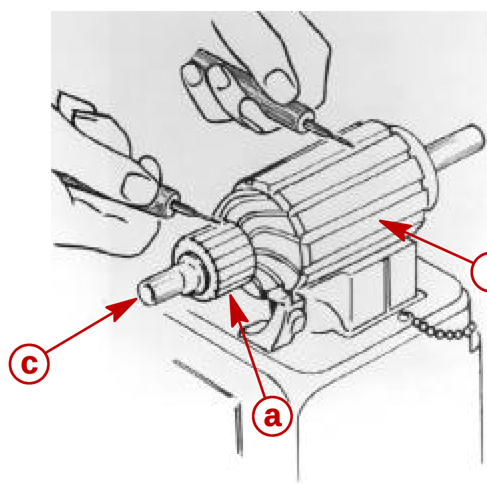


01440

a - Hack Saw Blade
b - Armature Core
c - Commutator

TESTING ARMATURE FOR GROUND

1. Use an ohmmeter (R x 100) to check for "no continuity" between commutator and armature core or commutator and shaft.
2. If continuity exists, armature is grounded and must be replaced.

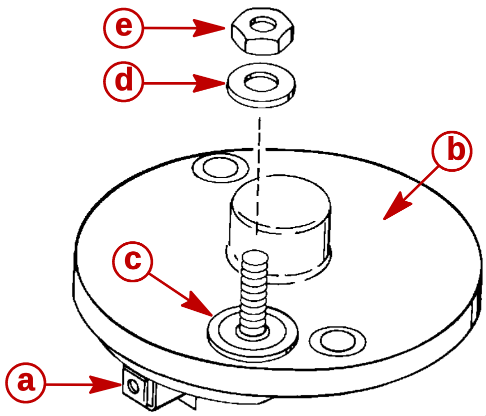


01441

a - Commutator
b - Armature Core
c - Shaft

Starter Motor Reassembly

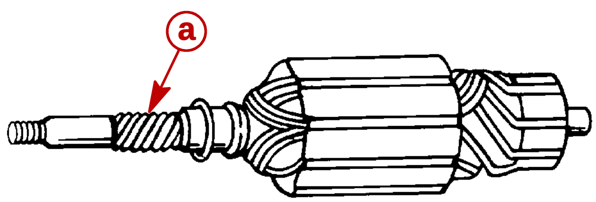
1. Reinstall brush assembly.



53075

a - Brush
b - End Cap
c - Fiber Washer
d - Metal Washer
e - Nut

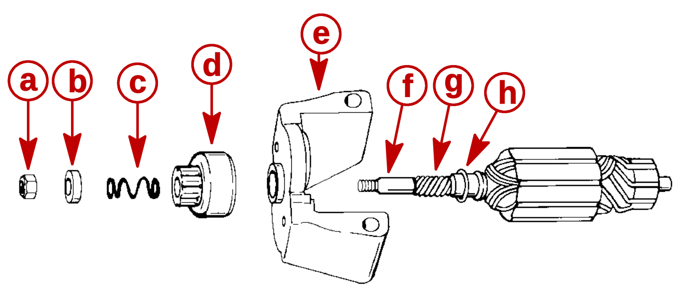
2. Apply a drop of SAE 10W oil to to helix threads on armature shaft. DO NOT over lubricate.



53080

a - Helix Threads

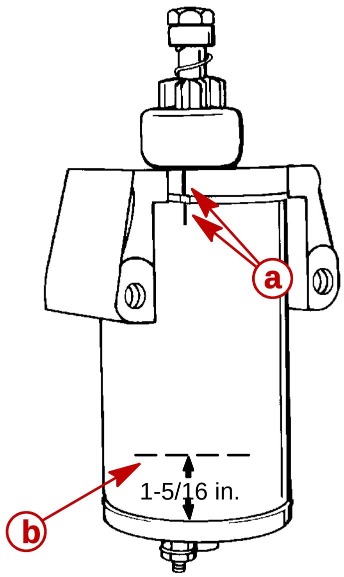
3. Apply a drop of SAE 10W oil to bushings in drive end cap and lower end cap. DO NOT over lubricate
4. Reinstall components on armature shaft. Use a new locknut and tighten securely.



53228

a - Locknut
b - Spacer
c - Spring
d - Drive Assembly
e - Drive End Cap
f - Armature Shaft
g - Helix Threads
h - Washer

5. Position armature into starter frame so that commutator end of armature is at end of starter frame where permanent magnets are recessed 1-5/16 in. (33.3mm). Align marks as shown.

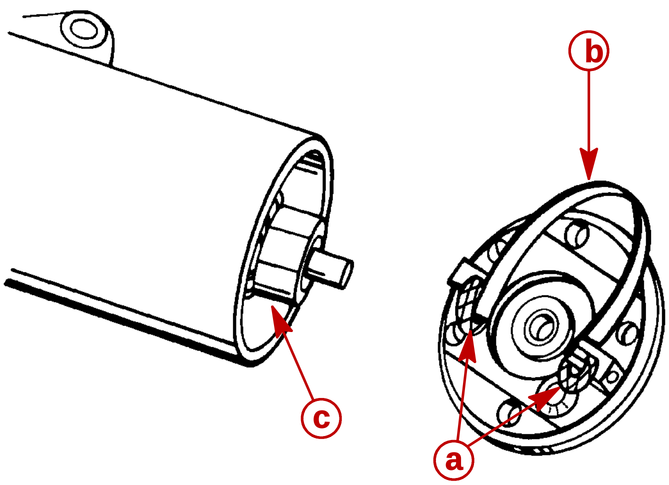


53082

a - Alignment Marks
b - Bottom Edge of Permanent Magnets

6. Install springs and brushes into brush holders. Spread brushes and hold in place with a strip of spring steel.

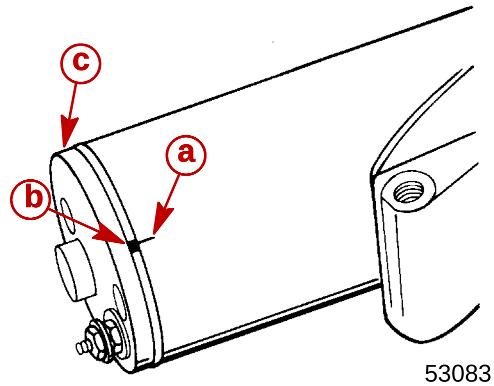
7. Push in on drive end of shaft so that commutator will extend out of starter frame.



53213

a - Brushes
b - Spring Steel
c - Commutator

8. Install lower end cap onto starter frame.

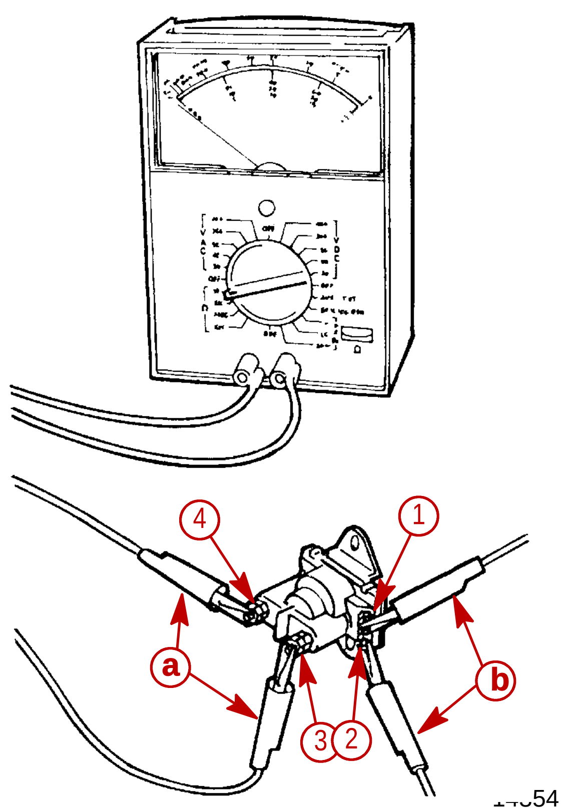


a - Alignment Mark; Must Align with Slot
b - Slot
c - Lower End Cap

Starter Solenoid Test

Test starter solenoid as follows:

1. Disconnect all leads from solenoid terminals.
2. Use an ohmmeter, set to (R x 1 scale) and connect between solenoid terminals 3 and 4.
3. Connect a 12-volt supply between solenoid terminals 1 and 2. Solenoid should click and meter should read zero ohms.
4. If meter does not read zero ohms (full continuity), replace solenoid.



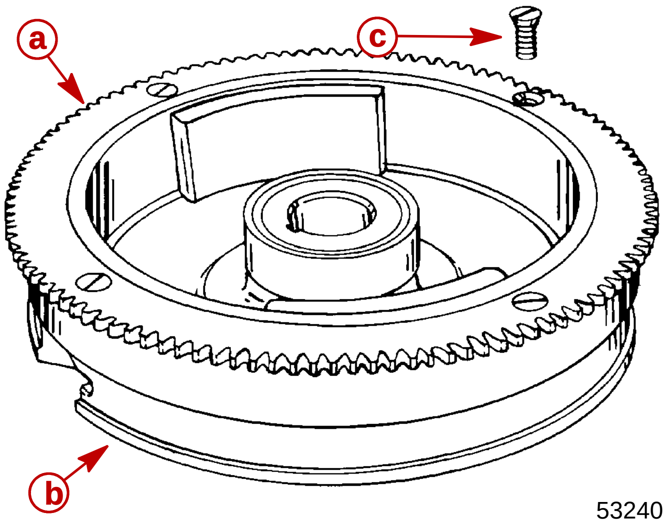
a - Ohmmeter Leads
b - 12-Volt Supply

Flywheel Ring Gear

Installation

IMPORTANT: Before installing ring gear on flywheel, inspect gear and flywheel for paint runs which will prevent ring gear from laying flat against flywheel.

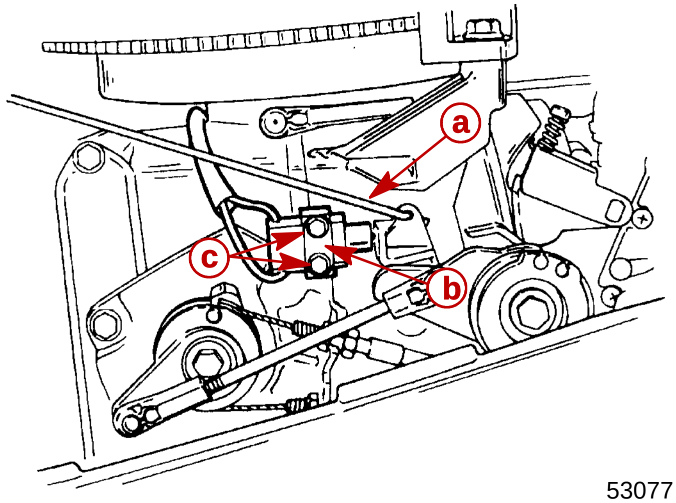
1. Inspect (and remove) any paint runs on ring gear and/or mounting surface on flywheel.
2. Place gear on flywheel with countersink side of mounting holes toward the outside.
3. Apply Loctite 271 to threads of 4 gear mounting screws and secure gear to flywheel. Torque screws to 100 lb. in. (11.3 N·m).



a - Ring Gear
b - Flywheel
c - Screws [Torque to 100 lb. in. (11.3 N·)]

Neutral Start Switch (Electric Start Tiller Handle Shift Models)

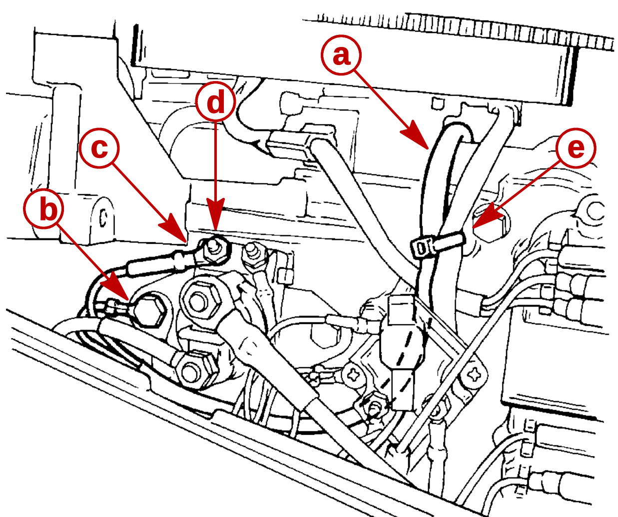
1. Mount neutral start switch onto control platform with 2 bolts and plate.
2. Torque mounting bolts to 5 lb. in. (0.6 N·m).



53077

a - Neutral Start Switch
b - Plate
c - Bolts [Torque to 5 lb in. (0.6 N·m)]

3. Route switch harness over block. Secure harness to stator harness with sta-strap.
4. Route harness behind rectifier. Attach BLACK lead to solenoid mount bolt. Attach Black lead with YELLOW sleeve to terminal 1 of starter solenoid.

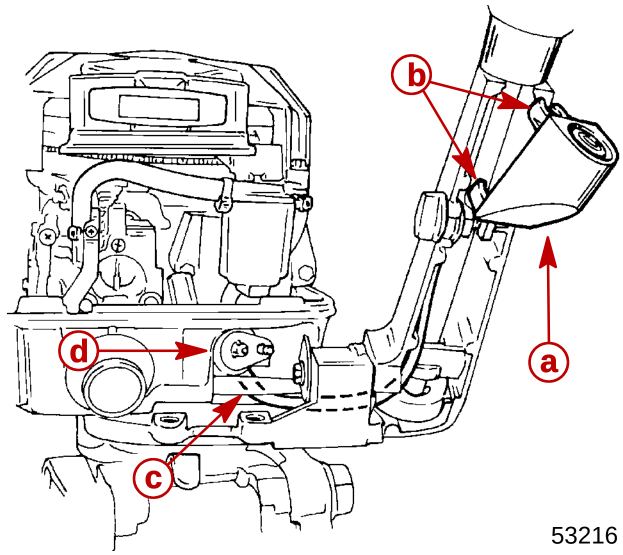


53076

a - Switch Harness
b - BLACK Lead
c - BLACK Lead with YELLOW Sleeve
d - Terminal 1
e - Sta-strap

Tiller Handle Start Button

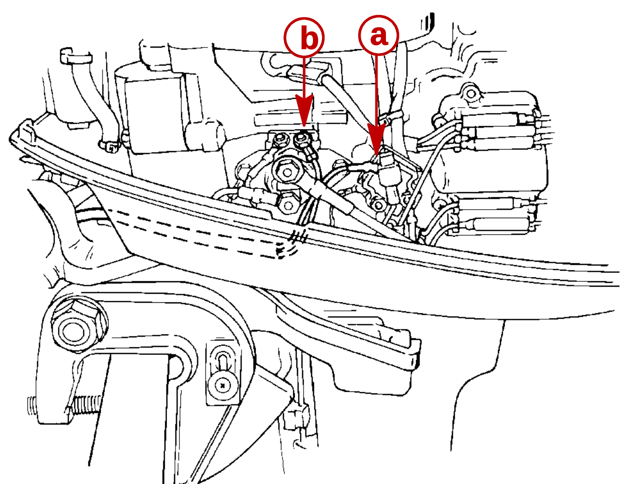
1. The tiller handle start button assembly is secured to the tiller handle by 2 semi-loops which snap fit onto the tiller throttle shaft. To remove the button assembly, pry the assembly away from the tiller handle with a flat tip screw driver.
2. The starter button harness is routed into the lower cowl through the fuel connector access hole.



53216

a - Start Button Assembly
b - Semi-Loops
c - Harness
d - Fuel Connector

3. The starter button harness is routed down the PORT side of lower engine to cowl.
4. The RED harness lead is connected to the POSITIVE (+) terminal of the rectifier. Torque attaching nut to 25 lb. in. (2.8 N·m).
5. The YELLOW/RED harness lead attaches to the #2 terminal of the starter terminal. Torque attaching nut to 15 lb. in. (1.7 N·m).



53215

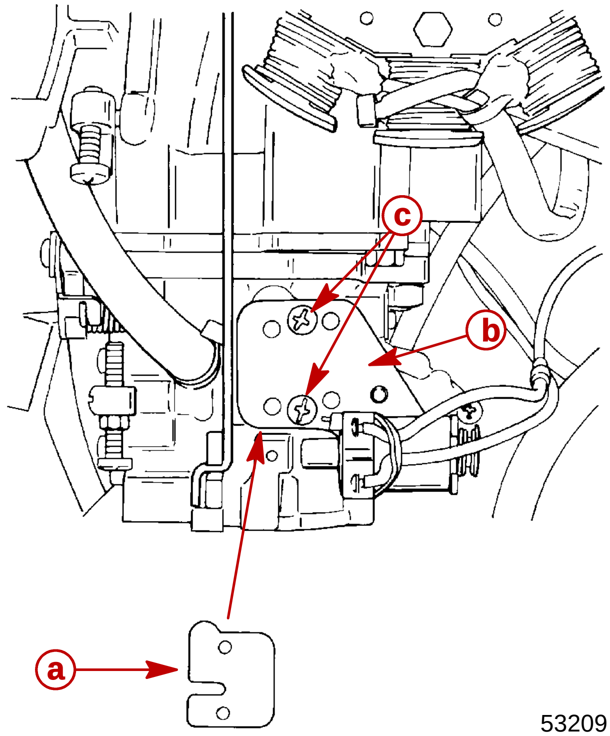
a - RED Lead [Torque nut to 25 lb. in. (2.8 N·m)]
b - YELLOW/RED Lead [Torque nut to 15 lb. in. (1.7 N·m)]

Choke Solenoid

Installation

IMPORTANT: New gasket MUST be positioned as shown when being installed.

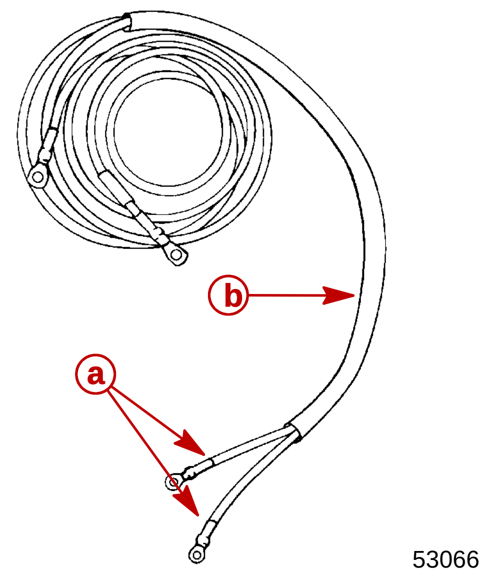
1. Install new gasket with solenoid plate assembly.
2. Secure assembly with 2 screws. Torque screws to 18 lb. in. (2.0 N·m).



a - Gasket
b - Solenoid Plate
c - Screws [Torque to 18 lb. in. (2.0 N·m)]

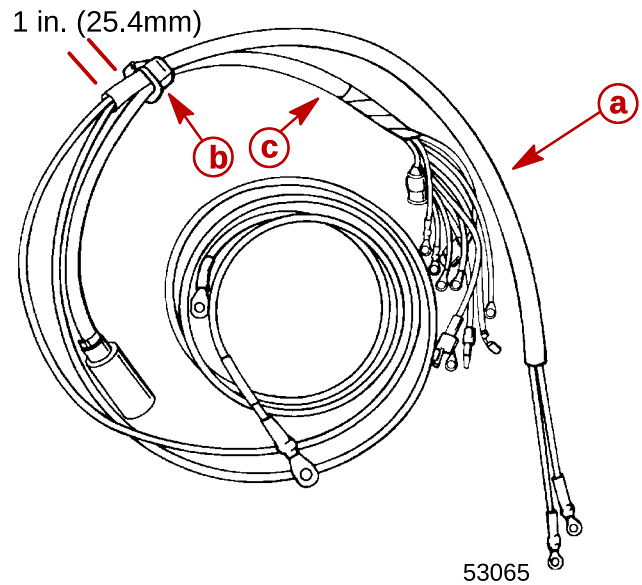
Battery Cables/Engine Wiring Harness (Remote Electric Start Models)

1. Slide battery cables through sleeve.



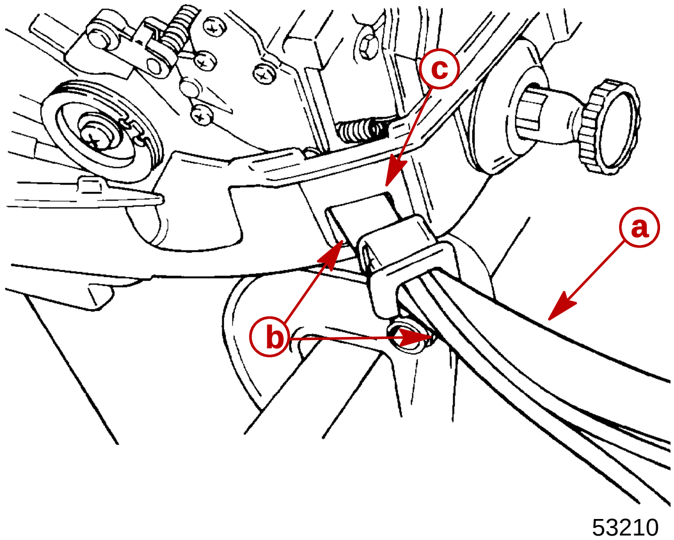
a - Battery Cables
b - Sleeve

2. Thread battery cable/sleeve through wire retainer of engine wiring harness. Verify 1 in. (25.4mm) of sleeve remains to the outside of wire retainer.



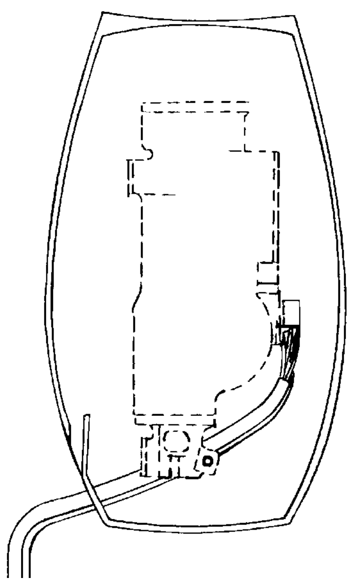
a - Sleeve
b - Retainer
c - Harness

3. Remove carburetor as outlined in Section 3.
4. Thread engine wiring harness first and then battery cable/sleeve through opening in bottom cowl.

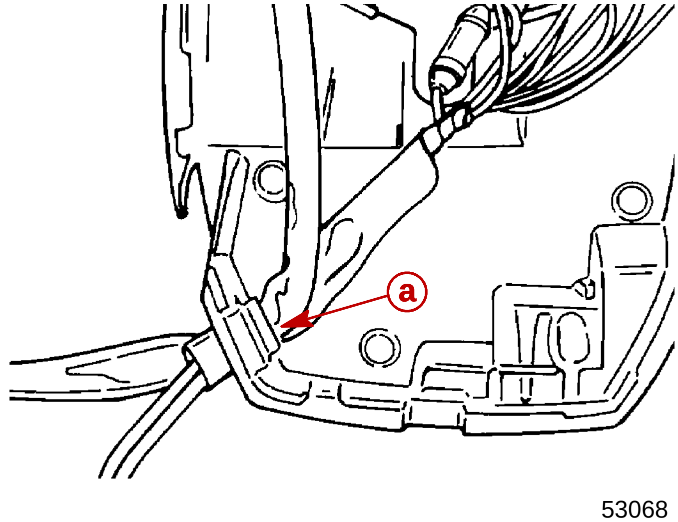


a - Harness
b - Battery Cable/Sleeve
c - Opening

5. Route engine wiring harness and battery cable/sleeve (under carburetor location) around to PORT side of cylinder block.

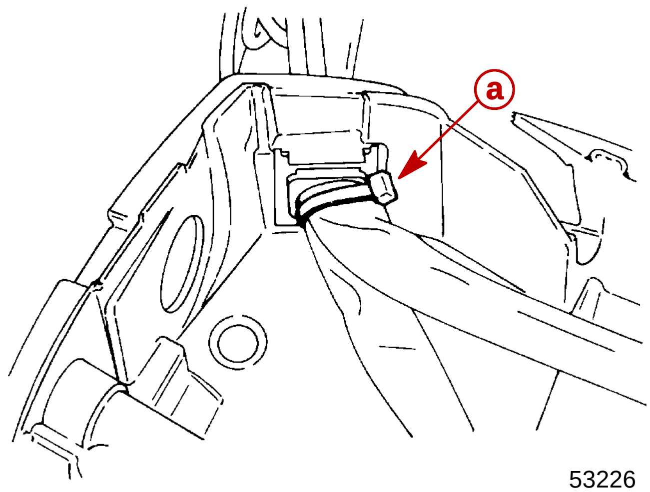


6. Push wire retainer into opening of bottom cowl and secure with clip.



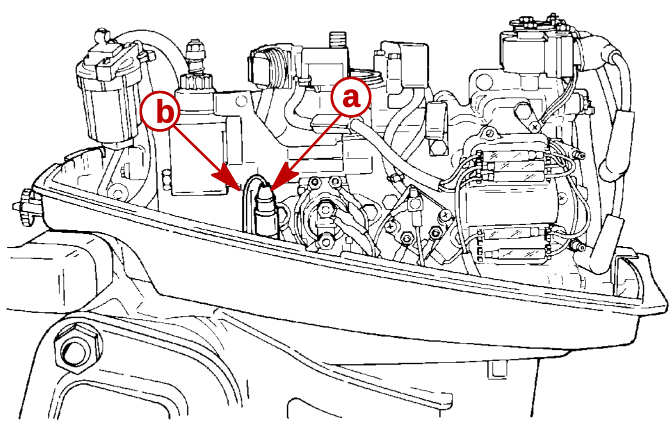
a - Clip

7. Secure harness and battery cable/sleeve with sta-strap just inside bottom cowl.
8. Reinstall carburetor as outlined in Sec 3A.



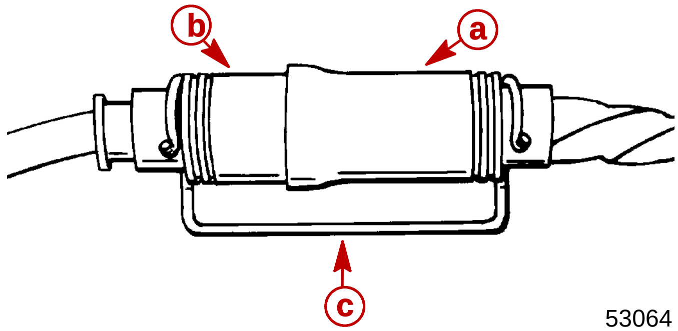
a - Sta-strap

9. Secure fuse holder in J-clip.



a - Fuse Holder
b - J-clip

10. Plug remote control harness connector into engine wiring harness connector and secure with harness connector retainer.

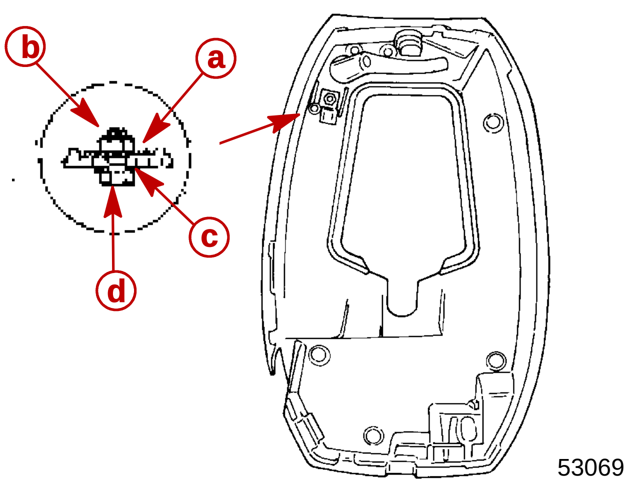


a - Remote Control Harness
b - Engine Harness
c - Retainer

Battery Cables (Tiller Handle Push Button Electric Start Models)

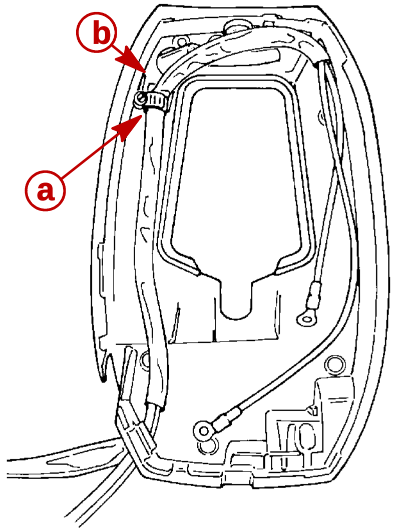
Installation

1. Fasten harness clamp to bottom cowl with nut, washer and bolt.



a - Clamp
b - Nut
c - Washer
d - Bolt

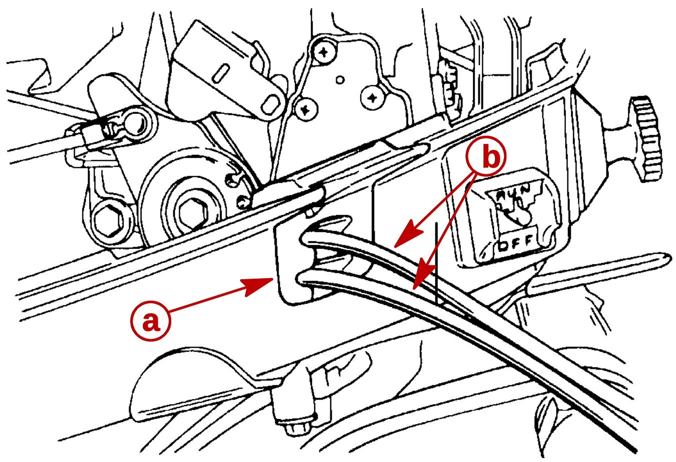
2. Slide battery cables through sleeve.
3. Slide harness clamp over battery cable sleeve and position cables into bottom cowl.
4. Position harness clamp onto clamp bracket in bottom cowl. Tighten clamp securely.



53067

a - Clamp
b - Bracket

5. Slide battery cable grommet over battery cables and install grommet into opening in starboard bottom cowl.



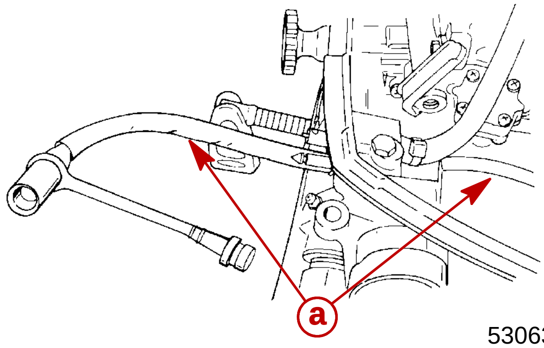
53149

a - Grommet
b - Cables

Plug Harness (Battery Charging Kit)

Installation

1. Install plug harness through fuel fitting opening in bottom cowl.
2. Route harness along PORT side of engine to rectifier.



53063

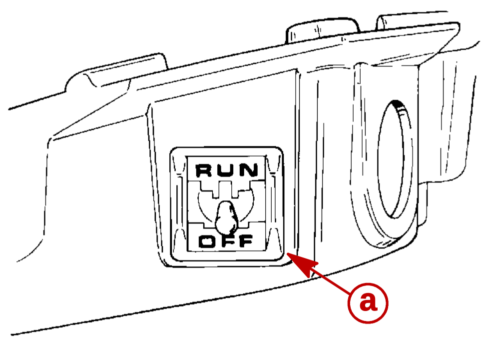
a - Harness

3. Refer to Section 2D for wiring connections.

Emergency Stop Switch (Lanyard Type)

Installation

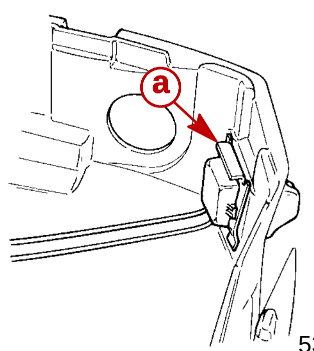
1. Route emergency stop switch wiring through opening in STARBOARD bottom cowl.



53054

a - Stop Switch

2. Secure stop switch into opening in bottom cowl using clip.



53055

a - Clip

3. Refer to Section 2D for wiring connections.

ELECTRICAL

Section 2C - Timing/Synchronizing/Adjusting

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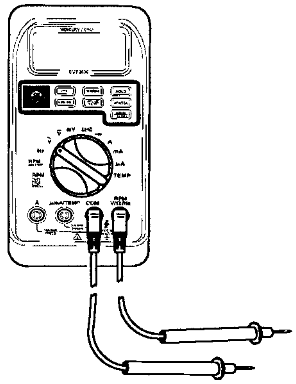
Specifications

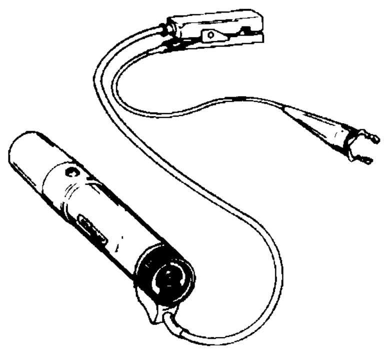
TIMING SPECIFI-CATIONS	**20 Jet 1994$^{1}/_{2}$ THRU 1998** **20/25 1994$^{1}/_{2}$ THRU 1996** **Electronic Spark Advance** **Idle @ 750 ± 50 RPM (In Forward Gear)** **Fast Idle Speed** **Maximum BTDC (Running)** **Setup Timing**	4° ± 2° B.T.D.C (Not Adjustable) 1400 RPM ± 250 RPM 25° ± 1 @5500 RPM 28° B.T.D.C. @ 3000 ± 200 R.P.M. (Set-up timing of 28° B.T.D.C. will be retarded to 25° B.T.D.C. @ 5500 R.P.M.)
	20 Jet 1999 AND NEWER **20/25 1997 AND NEWER** **Mechanical Spark Advance** **Idle @ 750 ± 50 RPM (In Forward Gear)** **Fast Idle Speed** **Maximum BTDC (Running)**	6° ± 1° B.T.D.C 1500 RPM ± 200 RPM 25° ± 1 @5500 RPM

Special Tools

1. DMT 2000 Service Tachometer 91-854009A1*



2. Timing Light 91-99379*

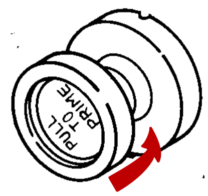


*May be obtained locally.

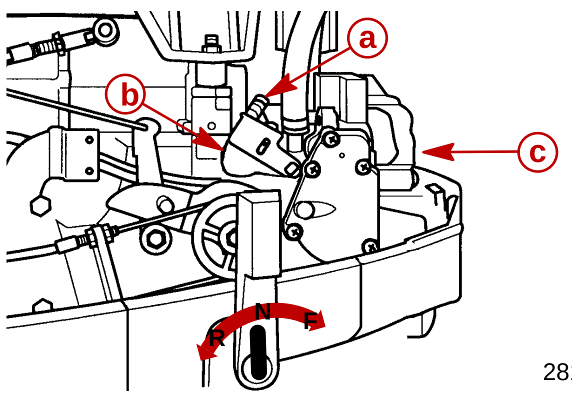
Timing/Synchronizing/Adjusting
Tiller Handle & Side Shift Models

NOTE: *Timing/Synchronizing adjustments are the same for tiller and side shift models unless otherwise specified.*

1. Check all electrical connections to ensure they are tight and secure (including battery connections on electric start models).
2. Shift outboard to “Neutral”, (on side shift model place throttle twist grip to “Slow”).
3. Push choke/primer all the way “In”. On models equipped with a primer, turn knob to full “Counterclockwise” position.



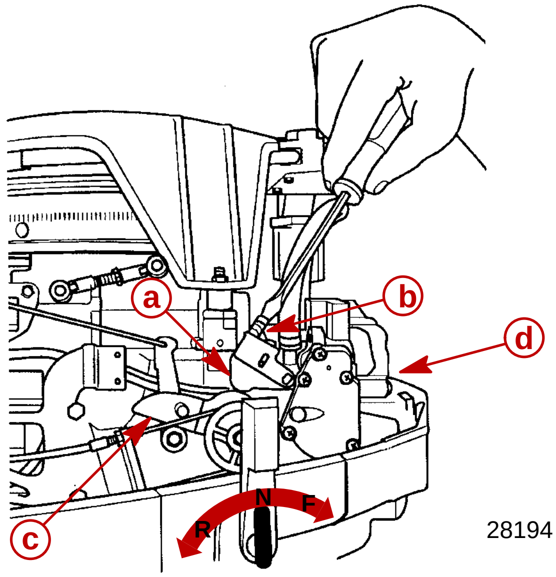
4. Check the tiller handle cables for proper adjustment. If necessary, adjust cables and remove any slack.
5. With the outboard placed in “Neutral”, back the idle speed screw off the cam follower.



28192

a - Idle Speed Screw
b - Cam Follower
c - Side Shift Model Shown

6. Turn idle speed screw "In" until the cam follower just makes contact with throttle cam then turn "In" one additional turn to slightly open throttle plate.

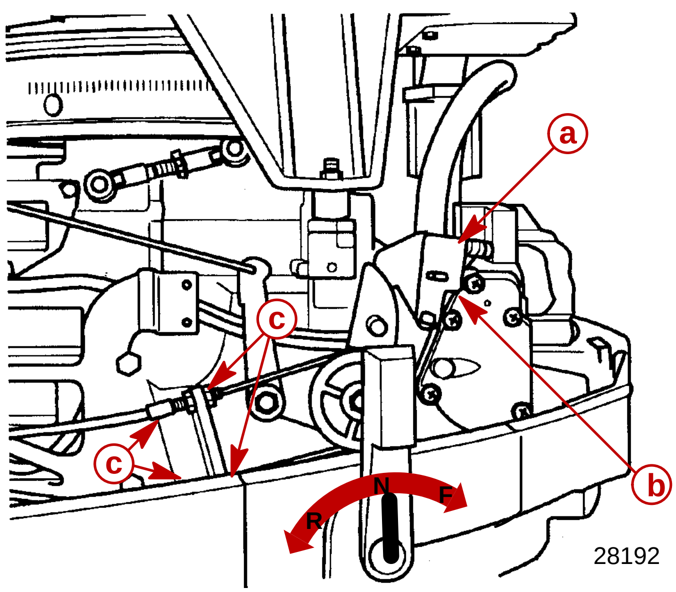


a - Cam Follower
b - Idle Speed Screw
c - Throttle Cam
d - Side Shift Model Shown

NOTE: *The throttle return spring on cam follower plate <u>should just contact</u> the fuel pump housing at wide open throttle position.* ***(Do not allow the throttle spring to act as a throttle stop****).*

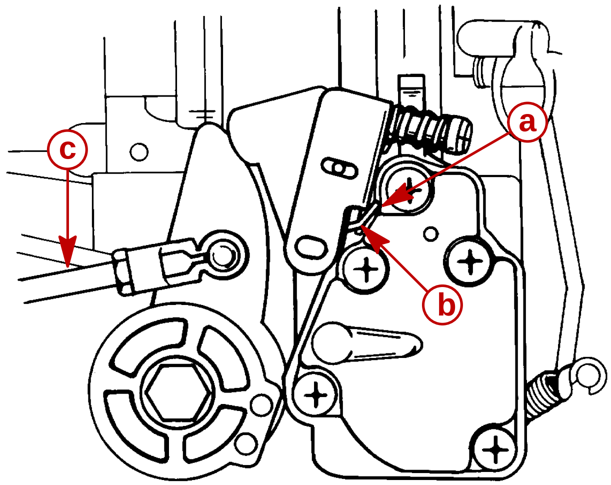
7. Place throttle twist grip to "Full Throttle" position. Verify that the throttle plate can achieve wide open throttle. If adjustment is necessary, adjust tiller cables or throttle link rod as shown.

Side Shift Models: Adjusting Tiller Handle Cables



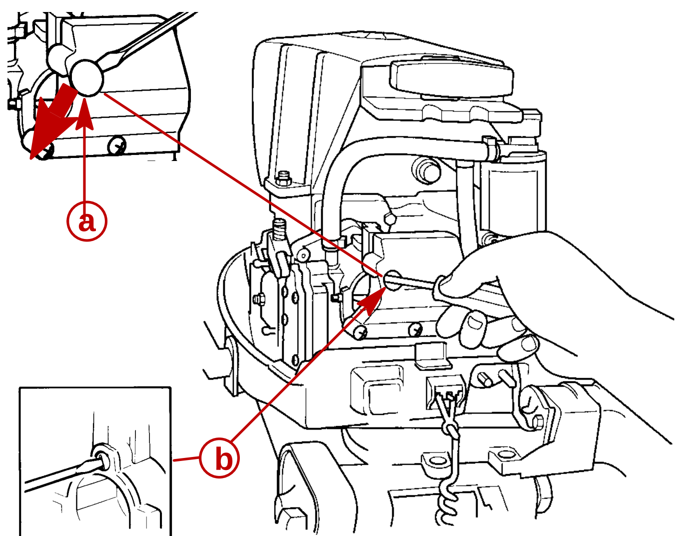
a - Cam Follower Plate
b - Fuel Pump Housing
c - Throttle Cables

Tiller Shift Models: Adjusting Link Rod



a - Contact Point (spring to just contact fuel pump housing)
b - Throttle Return Spring
c - Throttle Link Rod

8. Remove access plug from carburetor air intake cover.
9. Turn idle mixture screw in (clockwise) until **LIGHTLY** seated then back out to an initial setting (See Specifications Chart)



a - Access Plug
b - Idle Mixture Screw (Behind Access Plug)

⚠ WARNING
Keep clear of propeller while cranking and running the outboard motor

10. With the outboard in water, connect fuel line to engine, squeeze bulb until firm, and check for carburetor flooding.
11. Check choke operation, making sure choke shutter opens and closes all the way.

IMPORTANT: (Local Electric Start Models Only) Check the neutral start micro switch for proper operation. Try to start the engine in the "Forward", "Neutral", and "Reverse" gear with the electric start button. The engine must start in <u>"Neutral Only".</u>

Starting Procedure

15XD/25 SEAPRO/MARATHON MODELS ONLY

NOTE: *Outboards equipped with a thermostat will have a "Sporadic" tell tail water discharge.*

Pull choke to full "OUT" position and start the engine. Immediately after the engine starts, push the choke knob to "Full In" position. Check for water at the tell tale and at the idle relief holes. (Tell tale pressure to be per General Specifications).

20 JET/20/25 MODELS

NOTE: *Outboards equipped with a thermostat will have a "Sporadic" tell tail water discharge.*

Turn primer enrichener knob fully clockwise and pull to the "Full Out" position two (2) times, waiting approximately five (5) seconds between pulls, leaving the knob out after the second pull.

Start the engine. Immediately after the engine starts, push the primer knob to "Full In" position and check for water at the tell tail and idle relief holes. Allow the engine to warm up then turn the primer knob to the "Full Counterclockwise" position. (Tell tale pressure to be per General Specifications).

WARNING

To prevent personal injury or possible death, from loss of balance or stability while servicing the motor, DO NOT attempt to check or adjust timing while boat is in motion. Failure to follow one of the recommended servicing procedures may result in the person falling overboard or causing personal injury from fall in boat.

Timing Checking and Adjustment

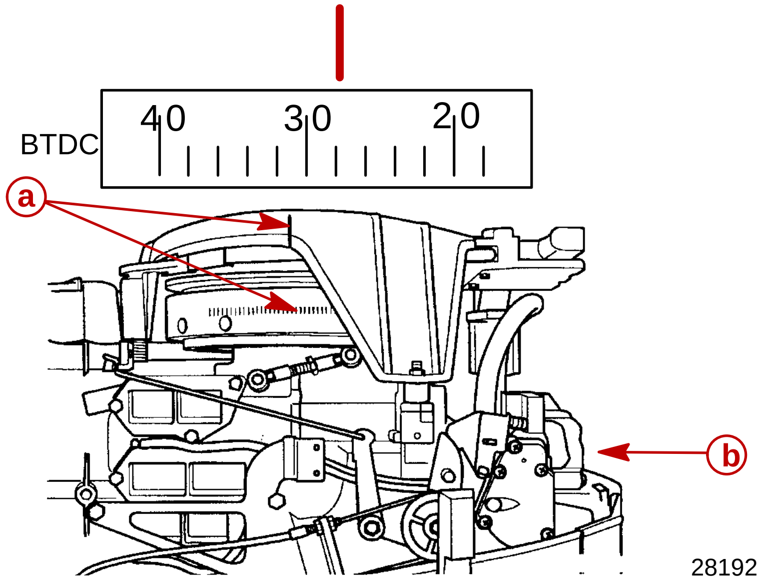
IMPORTANT: When checking the set-up timing with the engine running, one of the following test procedures must be followed.

Check maximum timing per the set-up specification while running the outboard:

- IN TEST TANK
- IN BACK-IN TEST TANK
- ON DYNAMOMETER
- WHILE STILL SECURED ON BOAT TRAILER "**Backed in the Water"**

ELECTRONIC SPARK ADVANCE MODELS
20/25 1994 $^1/_2$ THRU 1996 AND 20 JET 1994 $^1/_2$ THRU 1998

1. Using approved test procedure, place the outboard in “Forward” gear and check set-up timing. (If not within specifications, adjustment will be required).



a - Timing Mark
b - Side Shift Model Shown

⚠ WARNING

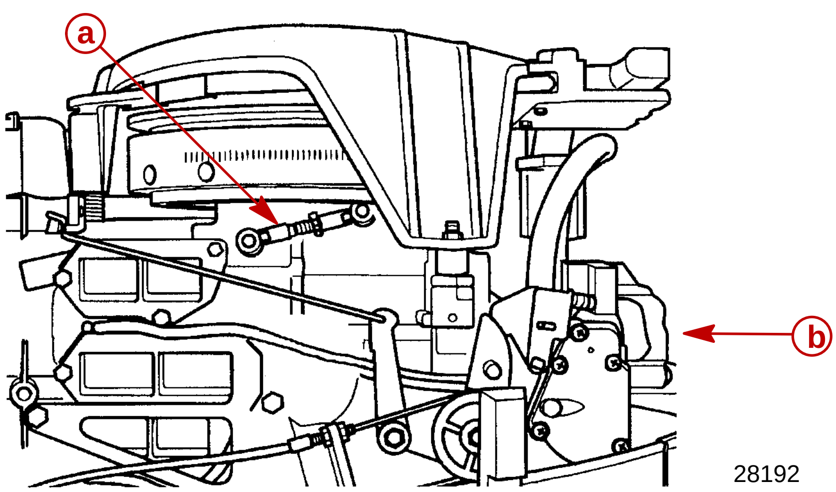
To prevent personal injury from spinning flywheel, Do Not attempt to adjust the trigger link rod (Maximum Timing Adjustment) with engine running.

ADJUSTING SET-UP TIMING

With the engine “OFF”, snap the trigger link rod socket off ball stud and:

- Extend rod length to “Advance” timing
- Shorten rod length to “Retard” timing

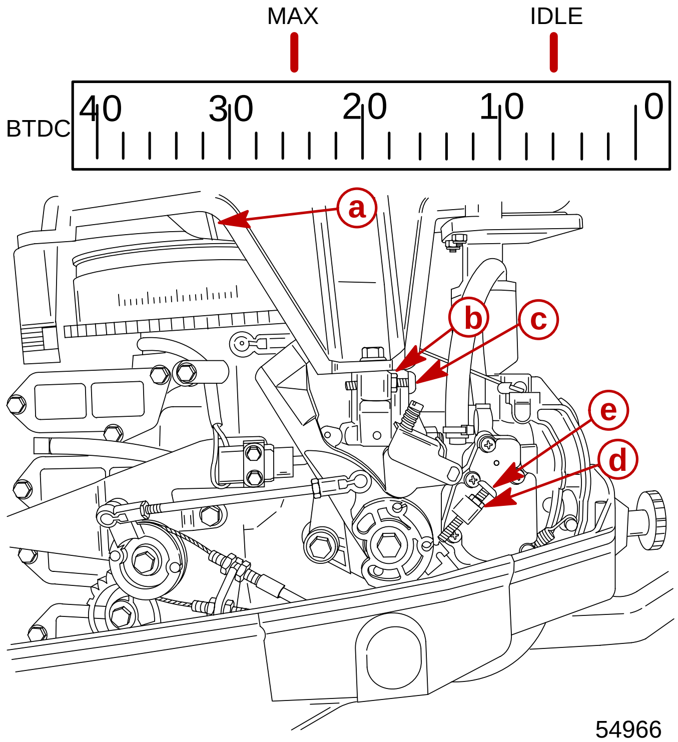
Snap link rod onto ball stud, re-start the engine and check set-up timing specification.



a - Trigger Link Rod (Set-up Timing Adjustment)
b - Side Shift Model Shown

MECHANICAL SPARK ADVANCE MODELS
20 JET/20/25 1997 AND NEWER

1. Using approved test procedure, place the outboard in “Forward” gear and check the maximum and idle timing. (If not within specifications, adjustment will be required)



a - Timing Mark
b - Maximum Timing Jam Nut
c - Maximum Timing Screw
d - Idle Timing Jam Nut
e - Idle Timing Screw

ADJUSTING MAXIMUM TIMING

1. Loosen maximum timing jam nut and turn maximum timing adjustment screw in/out to obtain specified timing.

NOTE: *Turning screw* ***out*** *will “****advance****” timing. Turning screw* ***in*** *will “****retard****” timing.*

ADJUSTING IDLE TIMING

1. Loosen idle timing jam nut and turn idle timing adjustment screw in/out to obtain specified timing.

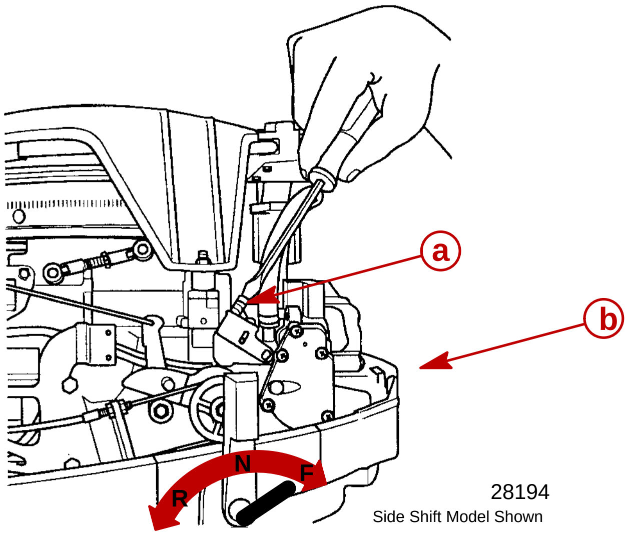
NOTE: *Turning screw* ***in*** *will “****advance****” timing. Turning screw* ***out*** *will “****retard****” timing.*

NOTE: *Outboards equipped with a thermostat will have a “Sporadic” tell tail water discharge.*

Adjusting Idle Speed

1. Start the outboard. After the outboard starts, push the primer knob to the “Full In” position, and immediately check for water at the tell tail and idle relief holes. After allowing the engine to warm up, turn the primer knob to “Full Counterclockwise” position. (Tell tail pressure should be per General Specification).
2. Run engine at 3500 R.P.M. and check stop button function, and lanyard stop switch function.

3. Adjust idle speed screw in "Forward" gear to specification.

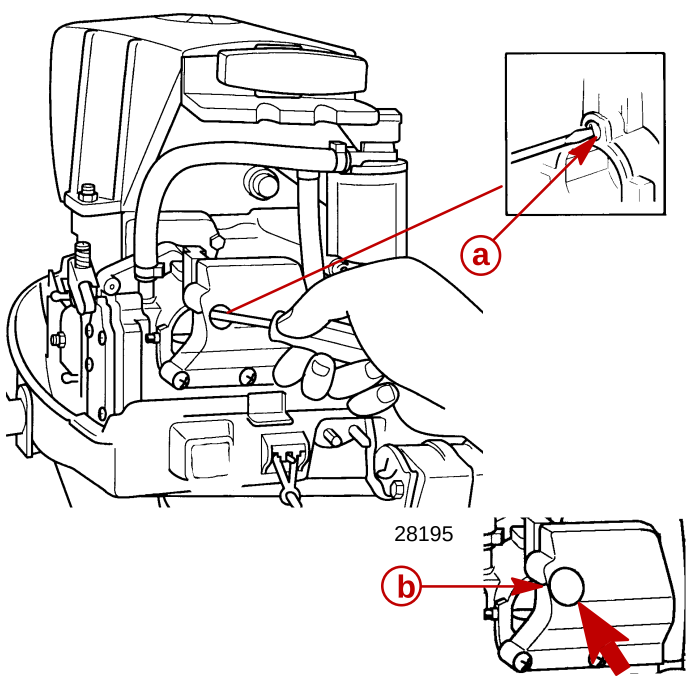


Side Shift Model Shown

a - Idle Speed Screw
b - Side Shift Model Shown

NOTE: *When setting idle mixture, DO NOT adjust leaner than necessary to attain reasonably smooth idling. When in doubt, set to the slightly rich side of highest R.P.M..*

4. Adjust carburetor for best performance, after clearing the engine. With engine running at idle speed in "Forward" gear, turn mixture screw "In" (clockwise) until engine starts to loose R.P.M., fire unevenly, and or misfires. Back out 1/4 turn or more. (See General Specifications for minimum and maximum adjustment).
5. Check for too lean of mixture on acceleration. (Engine will "hesitate" or "stall" on acceleration). Readjust mixture if necessary. Install access plug.

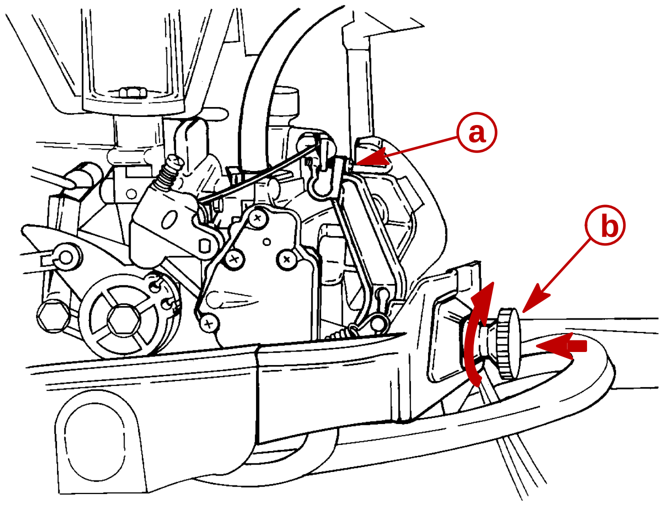


a - Idle Mixture Screw (Behind Access Plug)
b - Access Plug

6. Readjust idle speed screw in "Forward" gear to specification.

20 Jet/20/25 Models (Non Marathon/SeaPro)

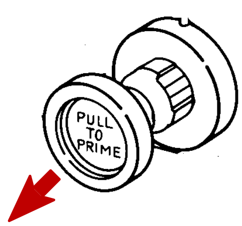
1. With the engine in “Neutral”, and the primer enrichener pushed to the “Full In” and “Full Clockwise” position, adjust the fast idle speed screw per specification.



52789

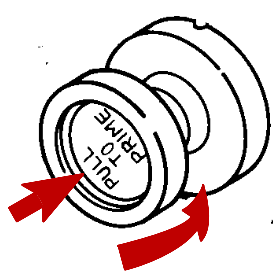
a - Fast Idle Speed Screw
b - Primer Enrichener

2. Check the primer enrichener circuit by pulling the primer enrichener knob to the full out position. The engine speed should drop a minimum of 300 R.P.M. and remain running for approximately five (5) seconds before stalling.

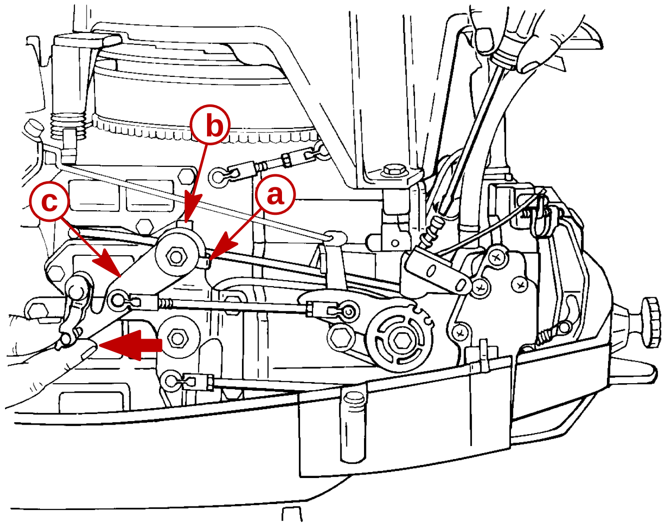


Timing/Synchronizing/Adjusting - Remote Control Models

1. Check all electrical connections to ensure they are tight and secure (including battery connections on electric start models).
2. Push primer enrichener to “Full In” position and turn the primer knob to “Full Counterclockwise” position.



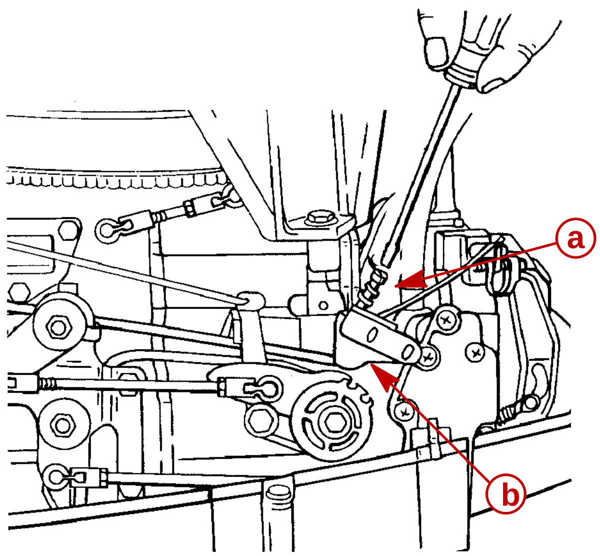
3. Manually pull throttle lever to “Full Aft” position until the stop tab on the throttle arm contacts the stop tab on the shift platform.



52798

a - Stop Tab
b - Shift Platform Stop Tab
c - Throttle Lever

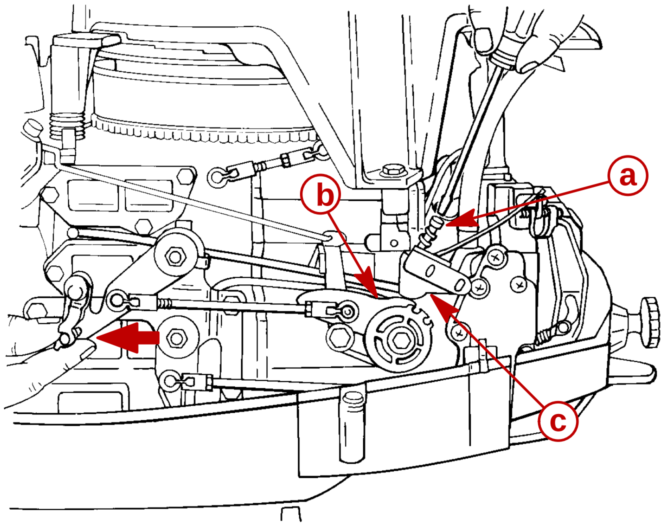
4. Back the idle speed screw off of cam follower.



52800

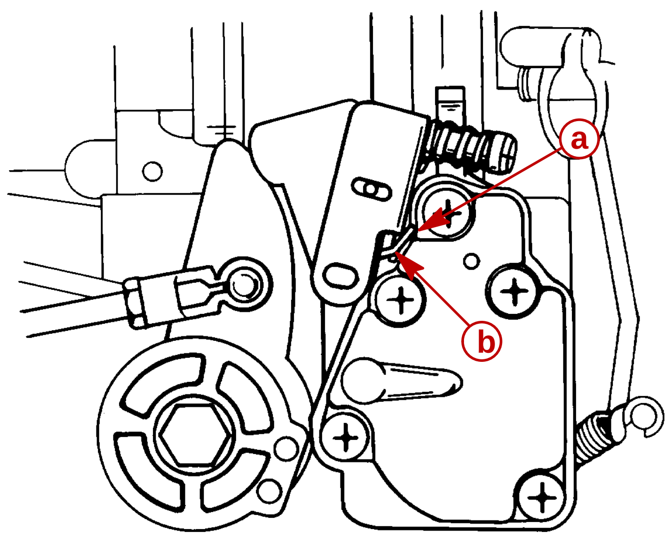
a - Idle Speed Screw
b - Cam Follower

5. Turn idle speed screw “In” until the cam follower just makes contact with throttle cam then turn “In” one additional turn to slightly open throttle plate.



a - Idle Speed Screw
b - Cam Follower
c - Throttle Cam

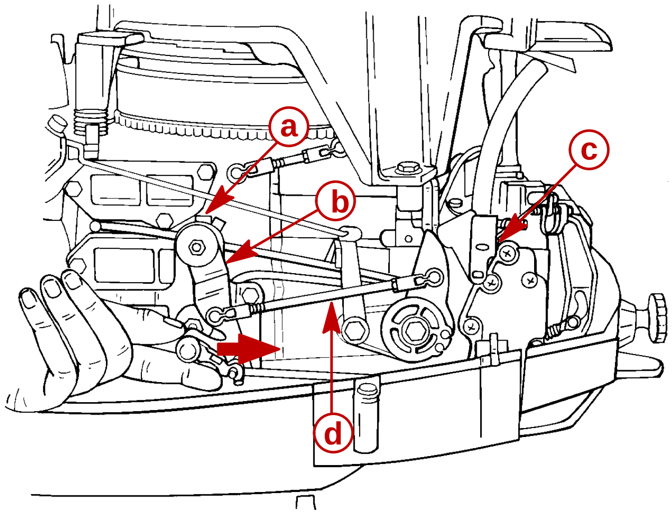
NOTE: *The throttle return spring on cam follower plate should just contact the fuel pump housing at wide open throttle position. If not, adjust the throttle link rod.* ***(Do not allow the throttle spring to act as a throttle stop****).*



52912

a - Contact Point (spring to just contact fuel pump housing)
b - Throttle Return Spring

6. Manually push throttle lever forward until it contacts the throttle stop on shift platform. Verify that the throttle plate can achieve wide open throttle and that no preload exists on the throttle return spring behind the cam follower plate. (Adjust throttle link rod if necessary)



52799

a - Throttle Stop
b - Throttle Lever
c - Return Spring (do not allow to act as a throttle stop)
d - Throttle Link Rod

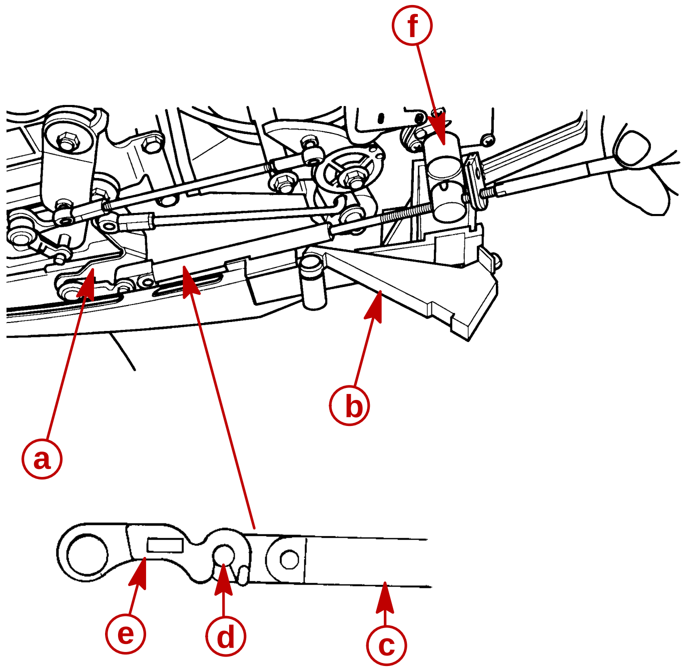
Shift and Throttle Cable Installation To The Outboard

Install the shift cable and throttle cable into the remote control and mount the remote control following instructions which are provided with the remote control.

NOTE: *Install the shift cable before the throttle cable. The shift cable is the first cable to move when the remote control handle is moved into gear.*

Shift Cable Installation

1. Move the remote control handle into full reverse position.
2. Place the engine shift lever into reverse position (toward rear) while rotating propeller. The propeller shaft will not rotate in either direction when in reverse position.
3. Open up the cable retainer cover and remove the barrel holder and front rubber grommet.
4. Install the shift cable onto the shift lever pin. lock in place with retainer latch.
5. Adjust the shift cable barrel so it will fit into the bottom hole of the barrel holder (f)and that the barrel holder will slide freely into the retaining pocket without pre-loading the shift cable.



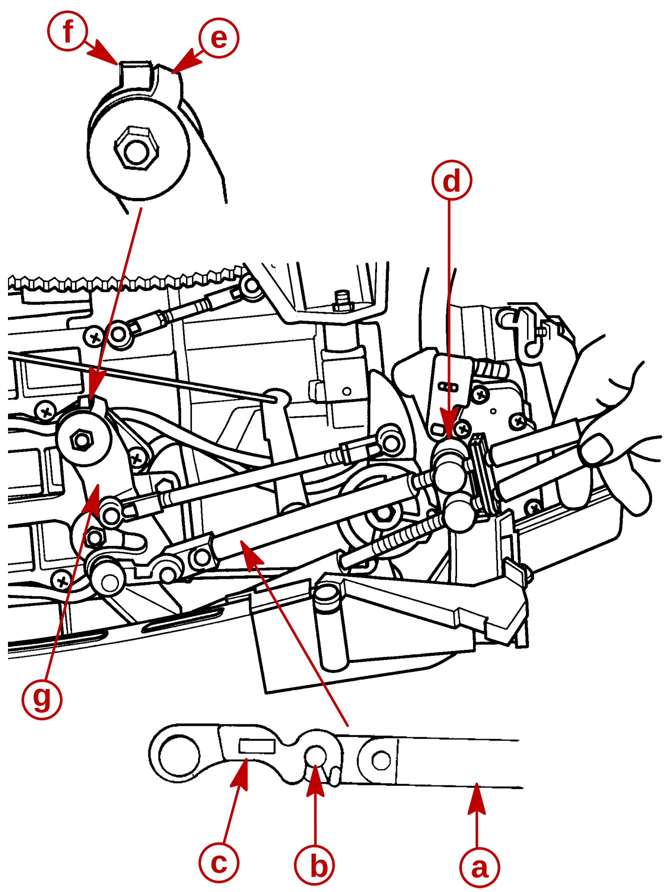
a - Shift Lever
b - Cable Retainer Cover
c - Shift Cable
d - Shift Lever Pin
e - Retainer Latch

6. Check shift cable adjustments as follows:
   a. With remote control shifted into forward the propeller shaft should lock solidly in gear. If it does not, adjust the cable barrel closer to the engine shift lever.
   b. Shift remote control into neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel away from the engine shift lever. Repeat steps a and b.
   c. Shift remote control into reverse while turning the propeller shaft. The propeller shaft should lock solidly in gear. If not, adjust the barrel away from the engine shift lever. Repeat steps a thru c.
   d. Return remote control handle to neutral. The propeller shaft should turn freely without drag. If not, adjust the barrel closer to the engine shift lever. Repeat steps a thru d.

Throttle Cable Installation

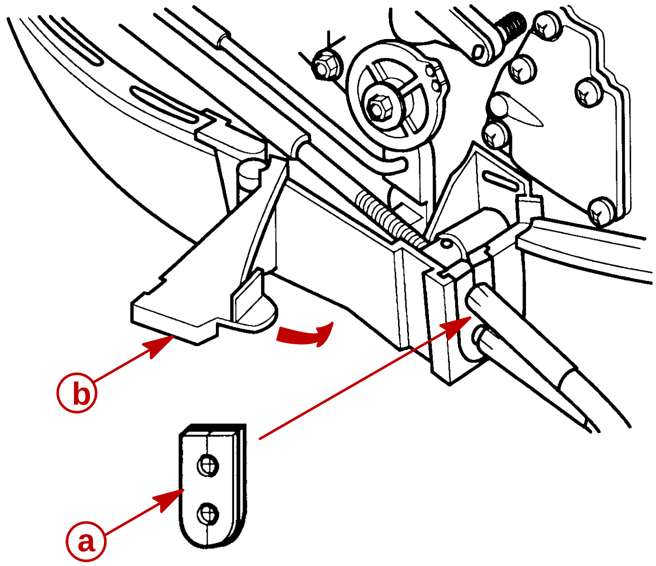
NOTE: *Attach Shift cable to engine prior to attaching throttle cable.*

1. Position the remote control handle forward, to wide-open-throttle position.
2. Install the throttle cable onto the throttle pin. lock in place with retainer latch.
3. Move throttle lever until tab contacts throttle stop. Adjust the barrel on the throttle cable so that the barrel will fit into the barrel holder.
4. Slip the barrel into the barrel holder and place the barrel holder into the retaining pocket.
5. Check the throttle cable adjustment as follows.
   a. Move the remote control handle back to neutral a few times and then return the handle back to forward wide-open-position.
   b. Recheck to make sure tab is contacting throttle stop.



a - Throttle Cable
b - Throttle Pin
c - Retainer Latch
d - Barrel Holder
e - Tab
f - Throttle Stop
g - Throttle Lever

6. Place the rubber seal (“a” side with holes towards front)) onto the control cables and install control cables, barrel holder and rubber seal into the cable holder as shown.
7. Lock the barrel holder in place with the cable retainer latch.



a - Rubber Seal
b - Retainer Latch

Starting Procedure

ELECTRIC START REMOTE CONTROL MODELS

NOTE: *Starting a cold engine will usually require the use of the choke/enrichener to start the engine. The choke/enrichener is operated by pushing in on the ignition key while starting the engine. It may also be helpful to prime the engine 1 to 3 times using the manual primer knob on the outboard.*

IMPORTANT: DO NOT lift fast idle lever up when starting a cold engine. Leave the lever in the down position until the engine starts.

1. Turn ignition key to the “START” position. If the engine is cold, push “In” on key to enrich the engine. If the engine fails to start in ten seconds, return key to “ON” position, wait 30 seconds and try again.
2. If engine begins to stall, re-activate the choke/enrichener until engine is running smoothly.

NOTE: *Starting Flooded Engine – Lift the fast idle lever to full up. Without using the choke/enrichener, continue to crank the engine for starting.*

3. After the engine has started, slowly lift up the fast idle lever to increase idle speed until engine is warmed up. Return fast idle lever to full down position.

NOTE: *Outboards equipped with a thermostat will have a “Sporadic” tell tail water discharge.*

4. Immediately after the engine starts, check for water at the tell tail and at idle relief holes. (Tell tail pressure should be per specification).

MANUAL START REMOTE CONTROL MODELS

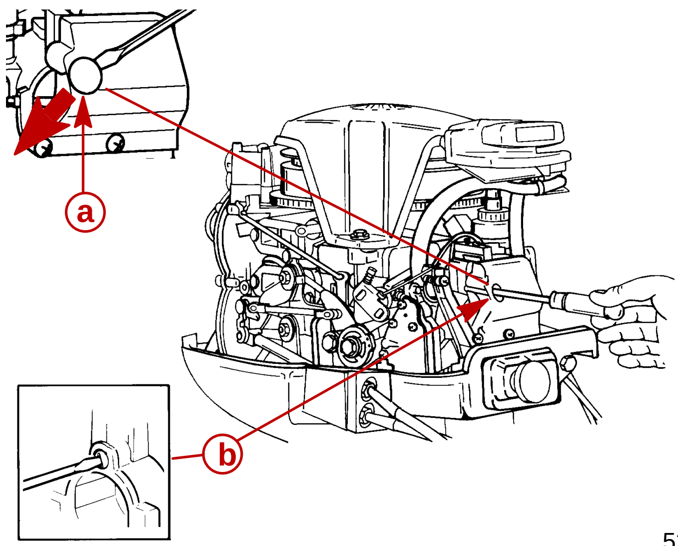
1. Turn primer enrichener knob fully “Clockwise” and “Pull” to “Full Out” position two (2) times, waiting approximately five (5) seconds between pulls, leaving the knob out after second pull.

NOTE: *Outboards equipped with a thermostat will have a “Sporadic” tell tail water discharge.*

2. Start the outboard. After the outboard starts, push the primer knob to the “Full In” position, and immediately check for water at the tell tail and idle relief holes. After allowing the engine to warm up, turn the primer knob to “Full Counterclockwise” position. (Tell tail pressure should be per General Specification).

Adjusting Idle Speed

1. Remove access plug from carburetor air intake cover.
2. Turn idle mixture screw in (clockwise) until **LIGHTLY** seated then back out to an initial setting (See Specifications Chart).



52804

a - Access Plug
b - Idle Mixture Screw (Behind Access Plug)

⚠ WARNING
Keep clear of propeller while cranking and running the outboard motor.

3. With outboard in the water, connect fuel line to engine, squeeze bulb until firm, and check for carburetor flooding.
4. Turn the ignition key switch, on the remote control box, to “on” position and depress the ignition key. This will activate the choke solenoid on the carburetor to enrich the fuel circuit.

ELECTRICAL

Section 2D - Wiring Diagrams

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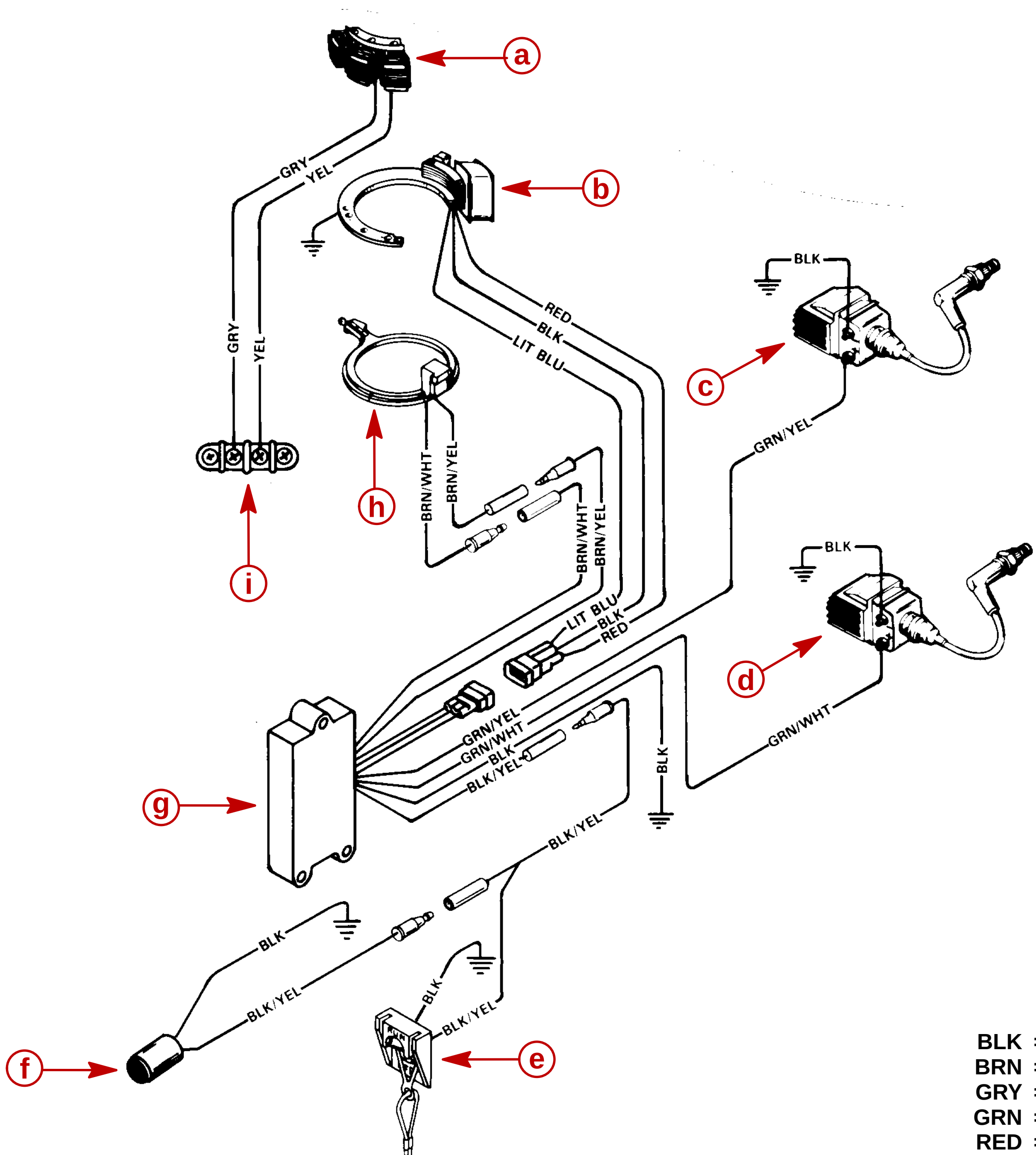
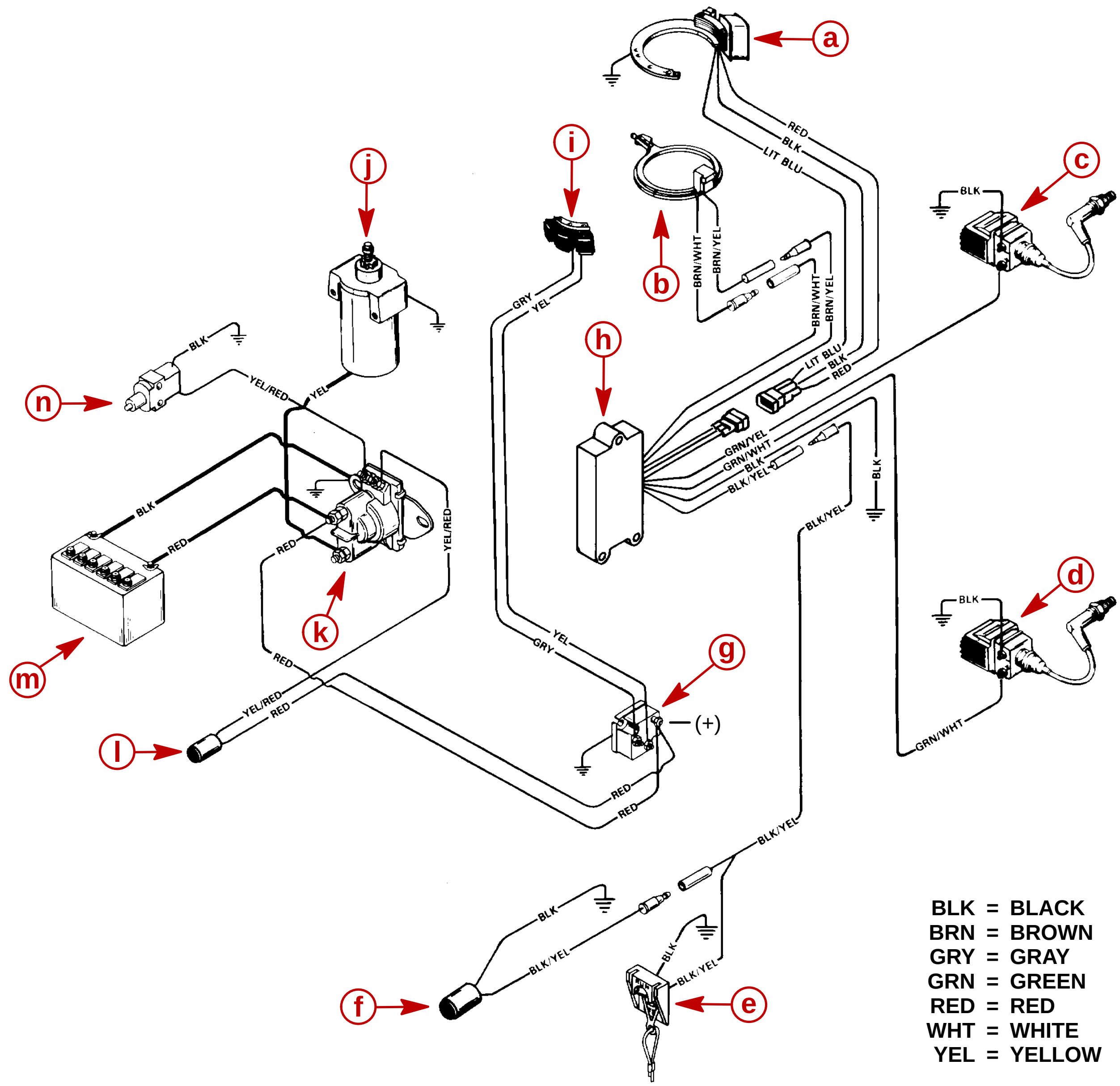
Manual Start Models (Electronic Advance)
Model 20/25 (1994$^1/_2$ THRU 1997)
Model 20 Jet (1994$^1/_2$ THRU 1998)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

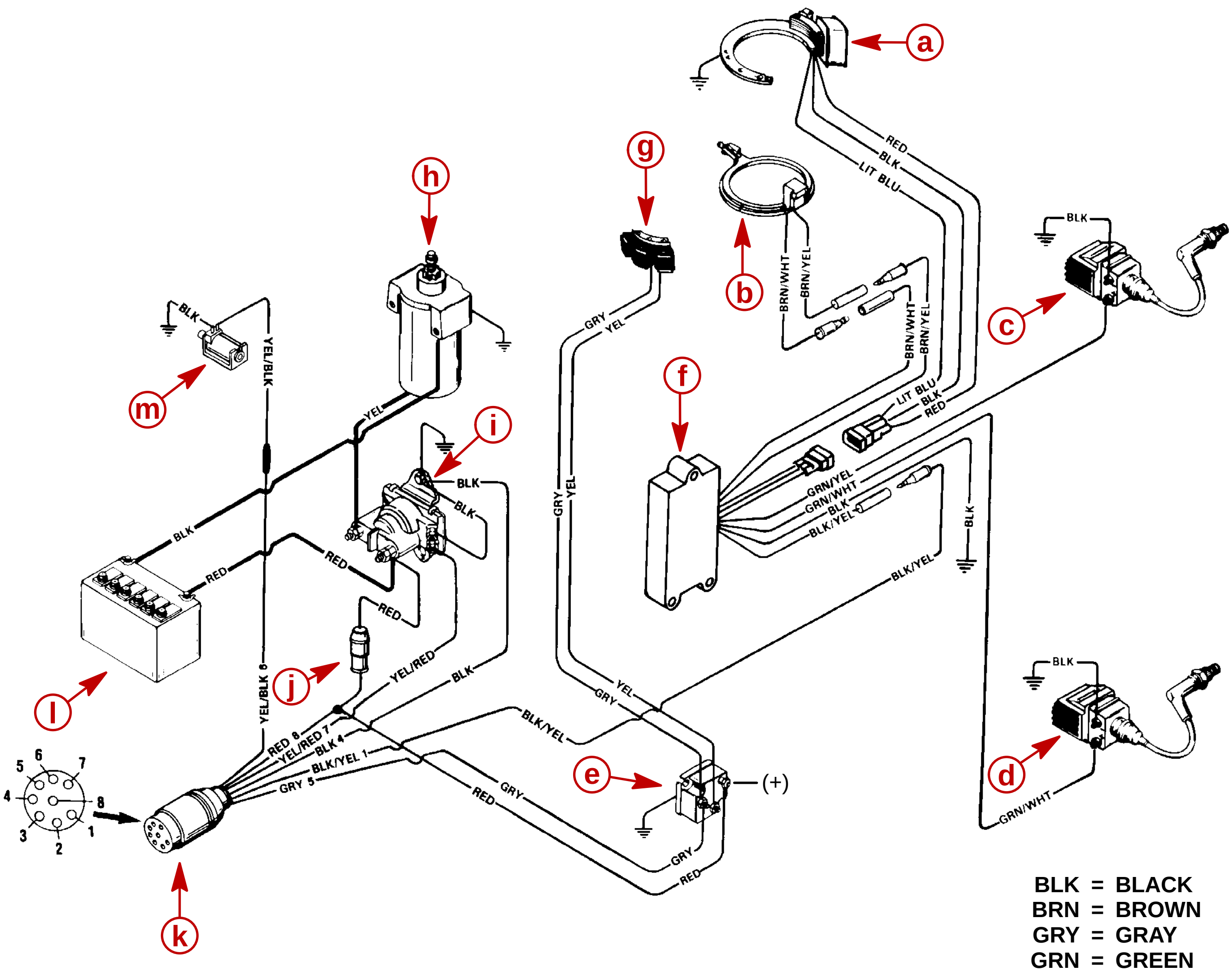
a - Charging Coils
b - Stator
c - Ignition Coil Top Cylinder
d - Ignition Coil Bottom Cylinder
e - Emergency Stop Switch
f - Stop Switch
g - Switch Box
h - Trigger
i . - Terminal Block

Electric Start Models with Tiller Handle Start Button (Electronic Advance)
Model 20/25 (1994 1/2 THRU 1997)



a - Stator
b - Trigger
c - Ignition Coil Top Cylinder
d - Ignition Coil Bottom Cylinder
e - Emergency Stop Switch
f - Stop Switch
g - Rectifier
h - Switch Box
i . - Charging Coils
j . - Starter Motor
k - Starter Solenoid
l . - Start Button
m - 12 VDC Battery
n - Neutral Start Switch

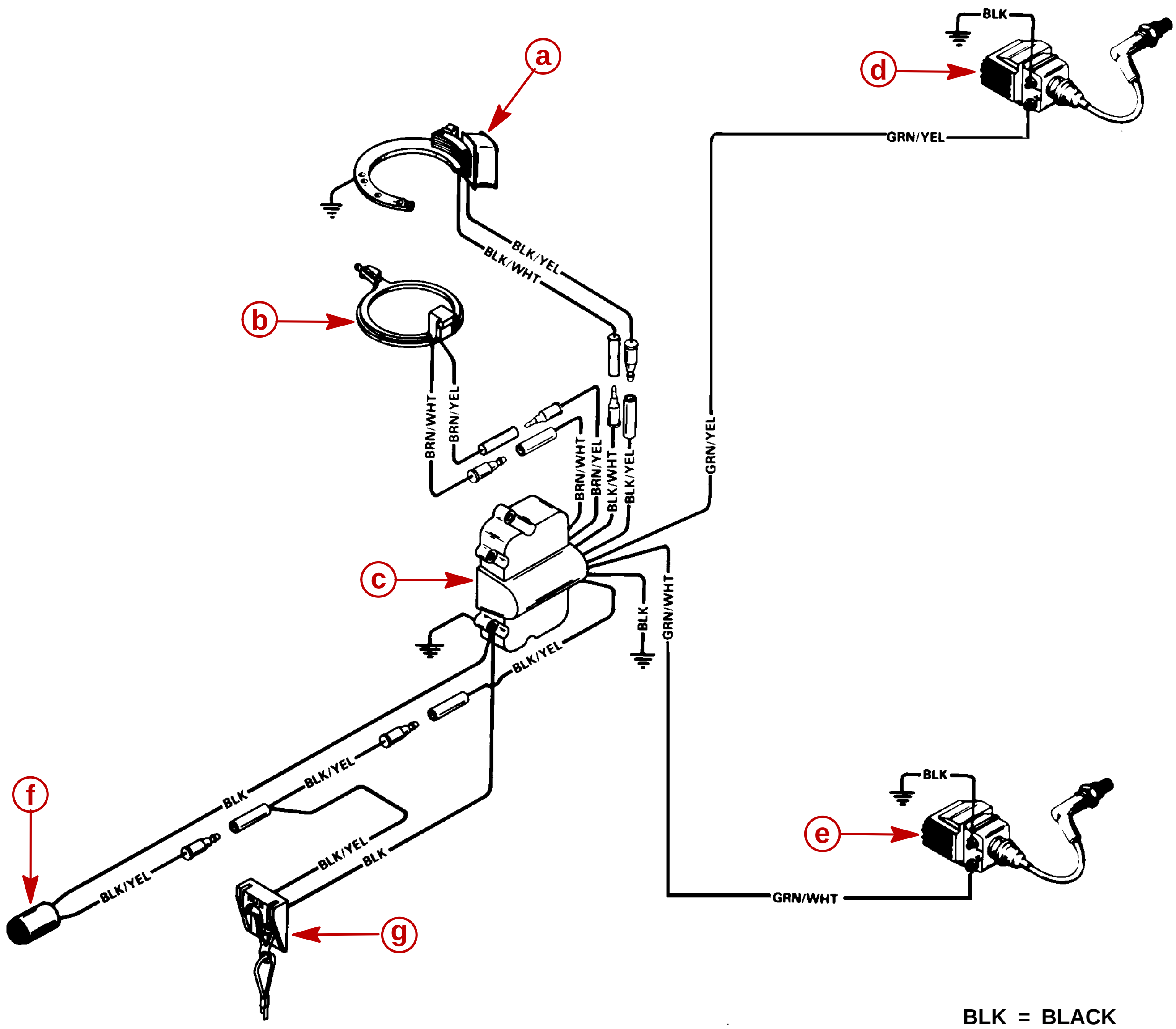
Electric Models Equipped with Remote Control (Electronic Advance) Model 20/25 (1994 1/2 THRU 1997)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

a - Stator
b - Trigger
c - Ignition Coil Top Cylinder
d - Ignition Coil Bottom Cylinder
e - Rectifier
f - Switch Box
g - Charging Coils
h - Starter Motor
i . - Starter Solenoid
j . - Fuse Holder (20 Ampere Fuse)
k - Remote Control Harness
l . - 12 VDC Battery
m - Neutral Start Switch

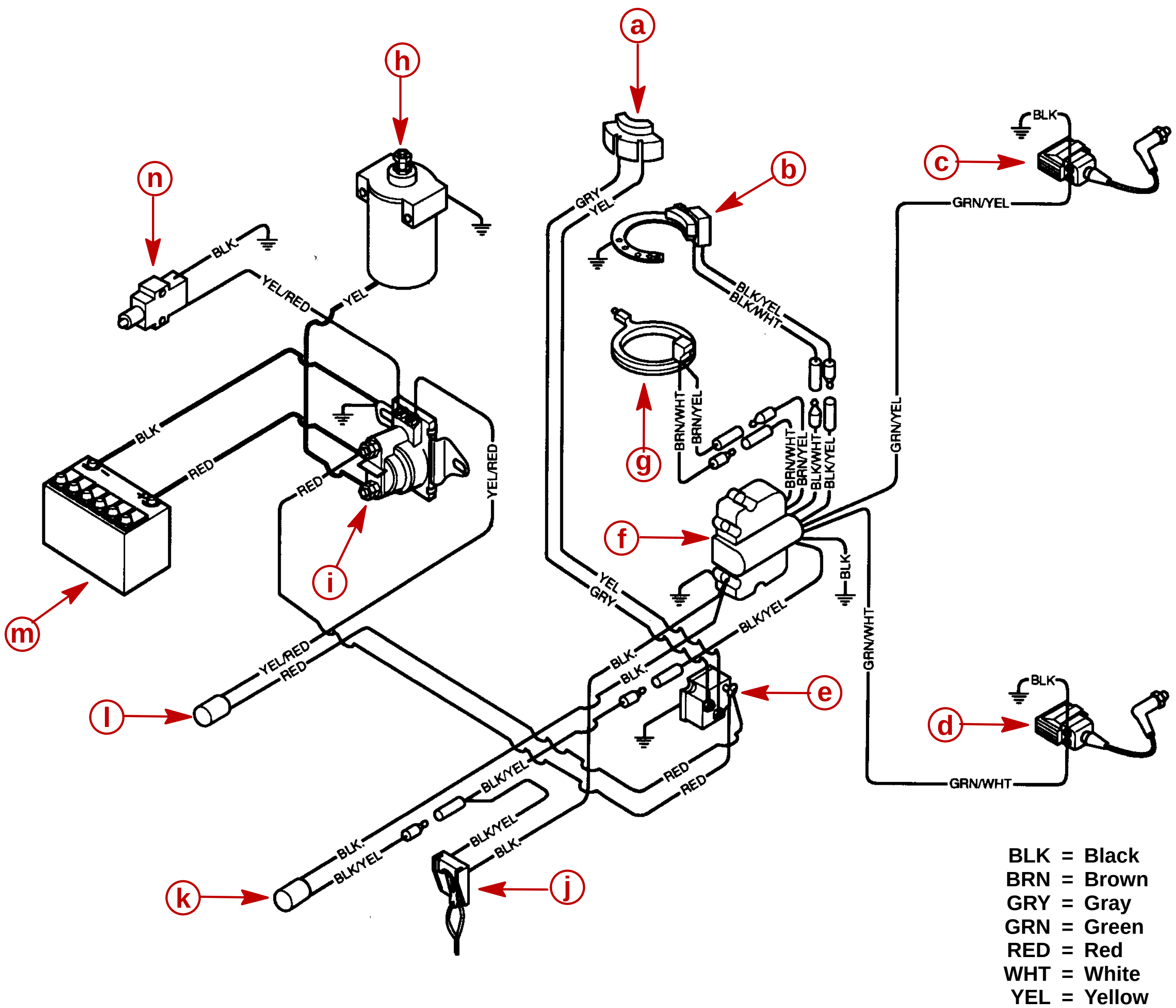
Manual Start Models (Mechanical Advance) Model 20/25 (1998)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

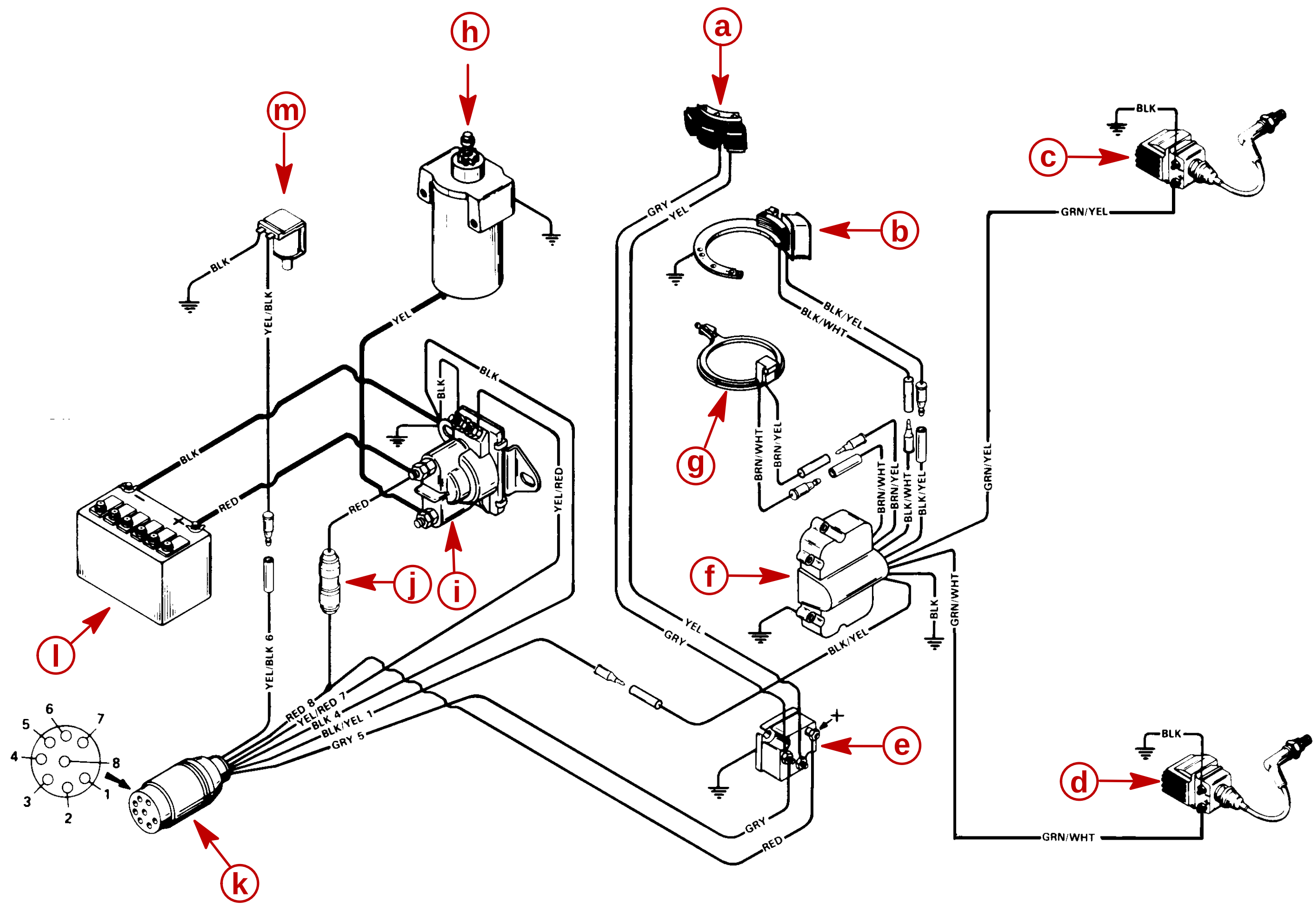
a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Top Cylinder
e - Ignition Coil Bottom Cylinder
f - Stop Switch
g - Emergency Stop Switch

Electric Start Models with Tiller Handle Start Button (Mechanical Advance) Model 20/25 (1998)



a - Charging Coils
b - Stator
c - Ignition Coil Top Cylinder
d - Ignition Coil Bottom Cylinder
e - Rectifier
f - Switch Box
g - Trigger
h - Starter Motor
i . - Starter Solenoid
j . - Emergency Stop Switch
k - Stop Switch
l . - Start Switch
m - 12 VDC Battery
n - Neutral Start Switch

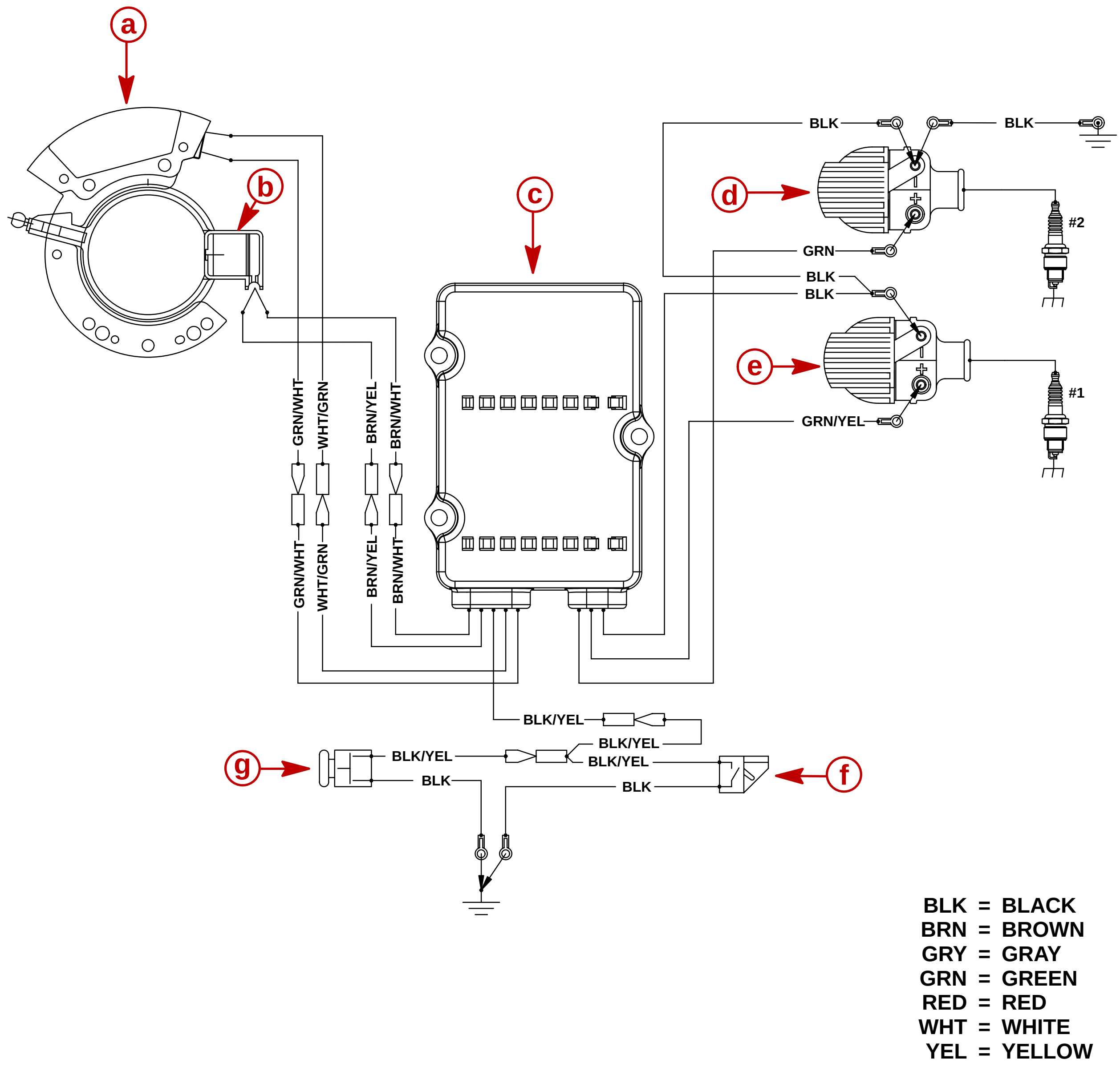
Electric Models Equipped with Remote Control (Mechanical Advance) Model 20/25 (1998)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

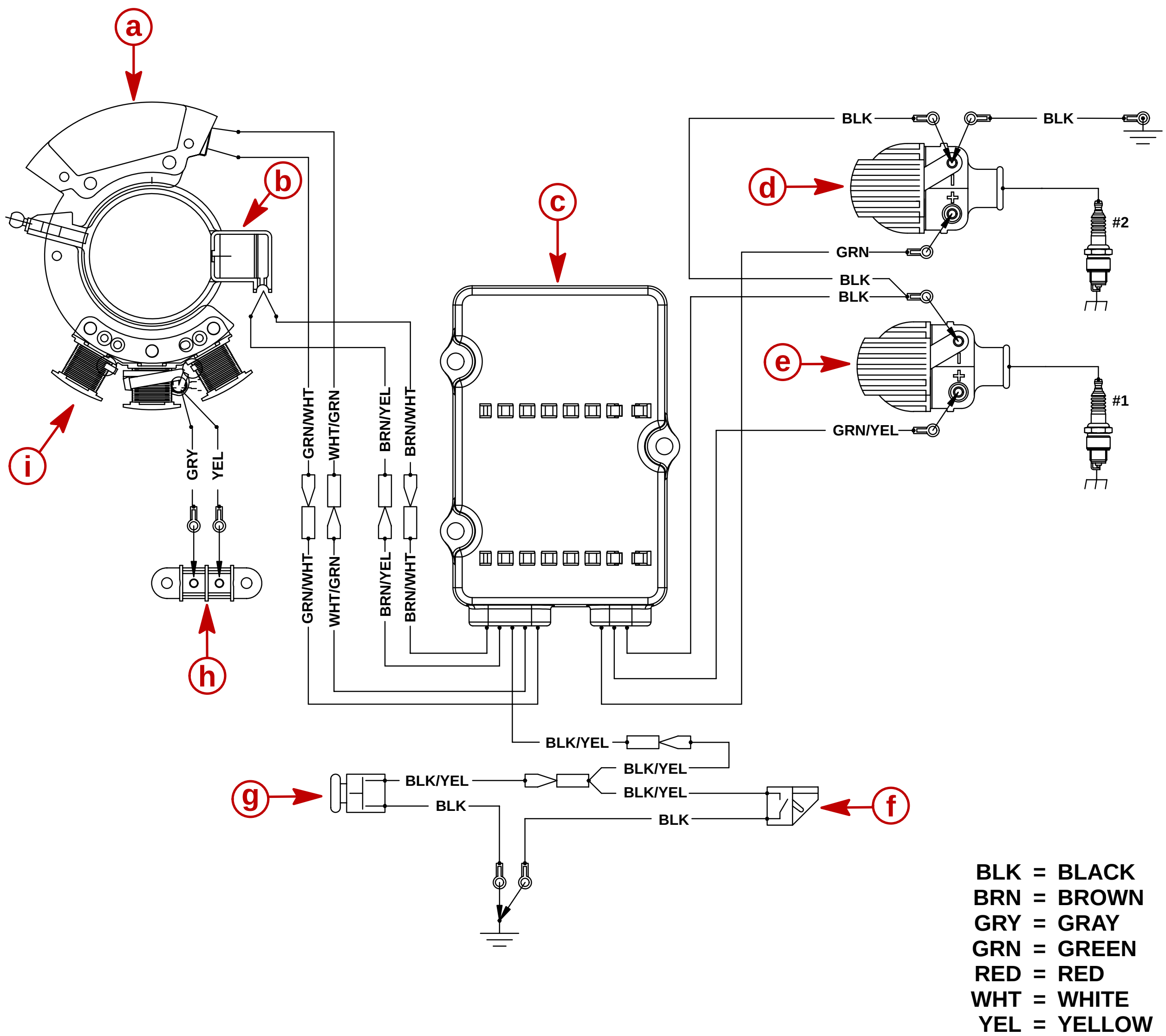
a - Charging Coils
b - Stator
c - Ignition Coil Top Cylinder
d - Ignition Coil Bottom Cylinder
e - Rectifier
f - Switch Box
g - Trigger
h - Starter Motor
i . - Starter Solenoid
j . - Fuse Holder (20 Ampere Fuse)
k - Remote Control Wiring Harness
l . - 12 VDC Battery
m - Choke Solenoid

Manual Start Ignition Wiring Diagram(RED Stator) Model 20 Jet/20/25 (1999 and NEWER)



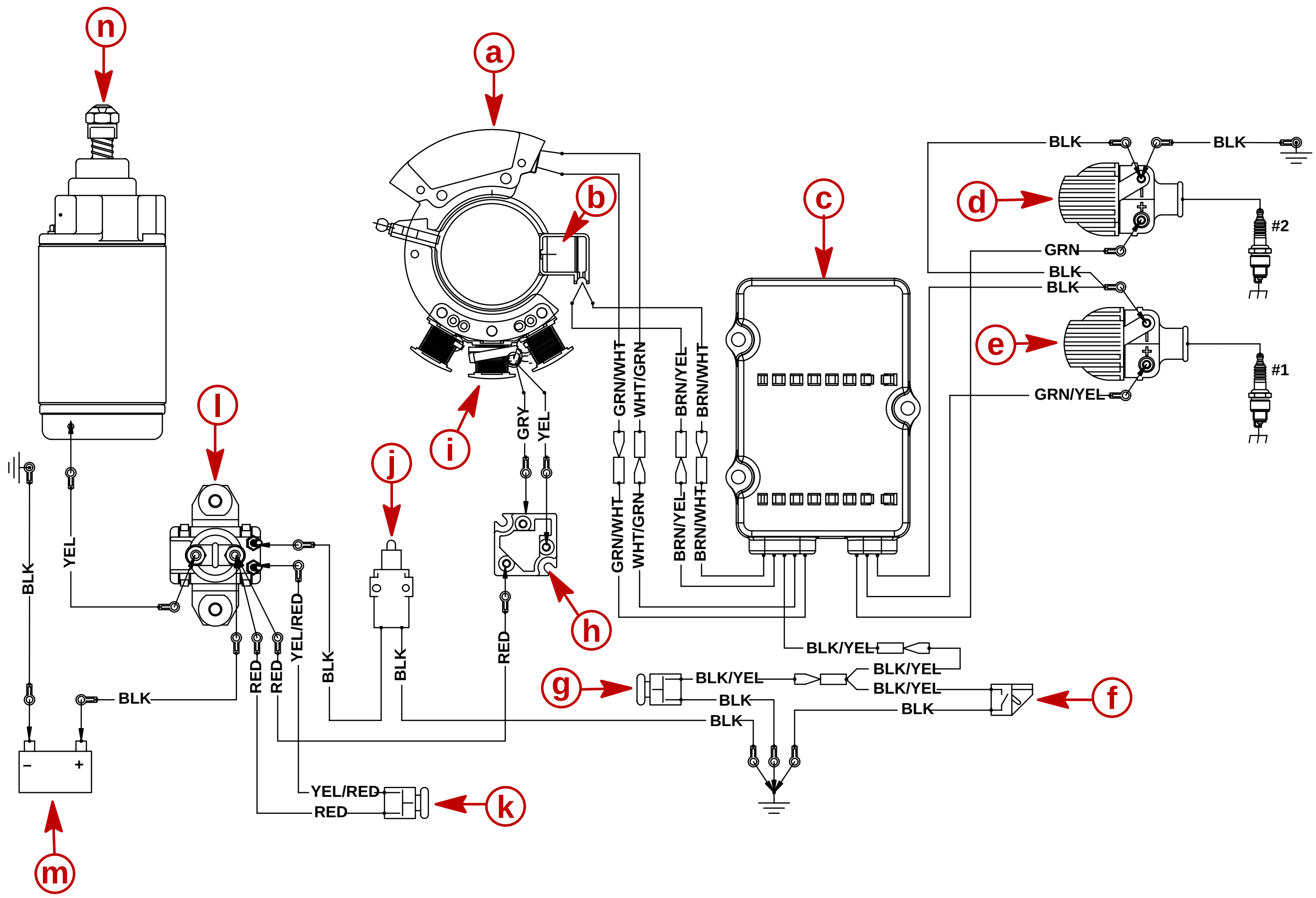
a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Bottom Cylinder
e - Ignition Coil Top Cylinder
f - Emergency Stop Switch
g - Stop Switch

Manual Start Wiring Diagram (RED Stator)
Model 20/25 (1999 and NEWER)(Work Model)



a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Bottom Cylinder
e - Ignition Coil Top Cylinder
f - Stop Switch
g - Emergency Stop Switch
h - Terminal Strip
i - Charging Coils

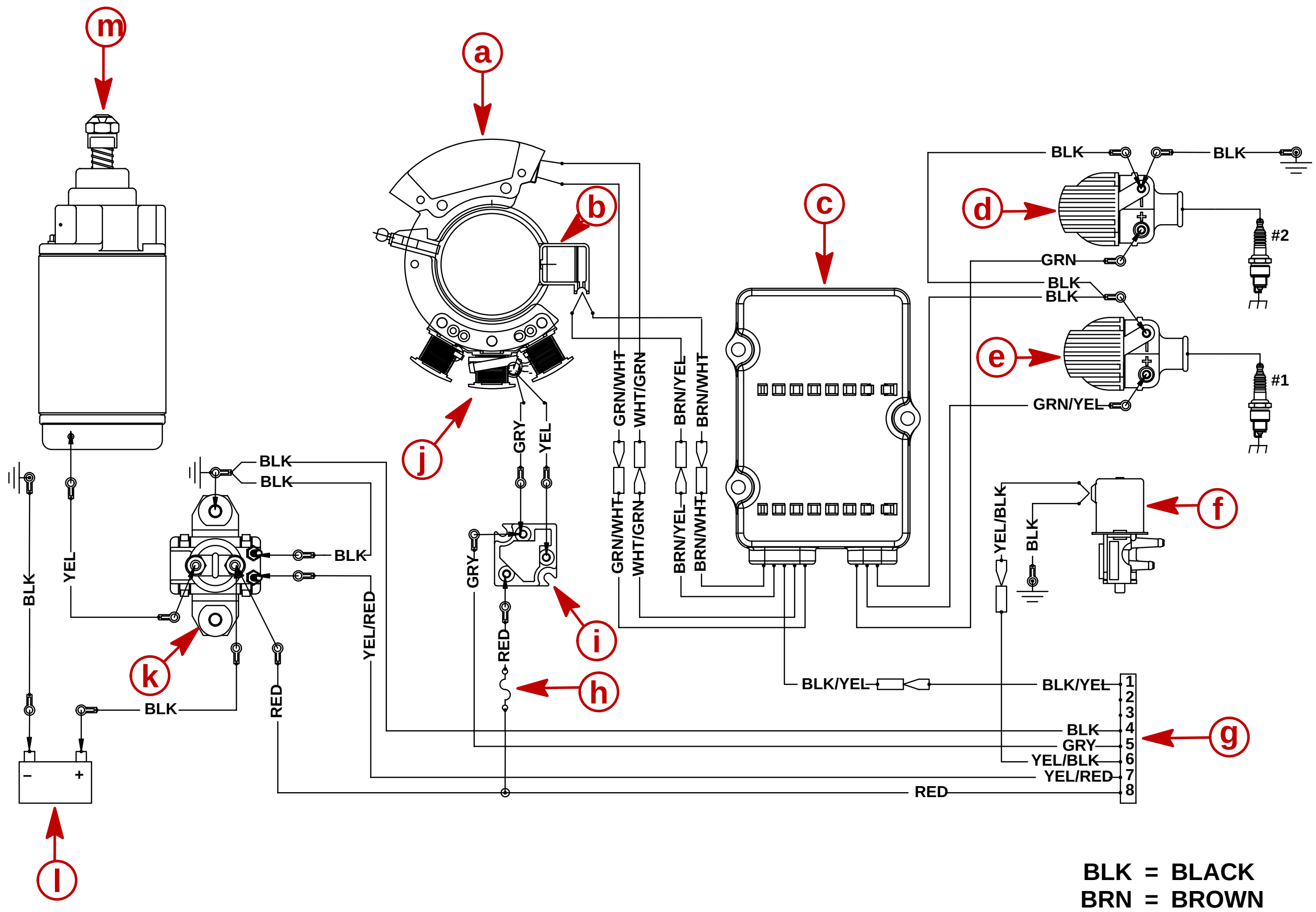
Electric Start Models with Tiller Handle Start Button (RED Stator) Model 20/25 (1999 and NEWER)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Bottom Cylinder
e - Ignition Coil Top Cylinder
f - Emergency Stop Switch
g - Push Button Stop Switch
h - Rectifier
i . - Charging Coils
j . - Neutral Start Switch
k - Push Button Start Switch
l . - Start Solenoid
m - 12 VDC Battery
n - Starter Motor

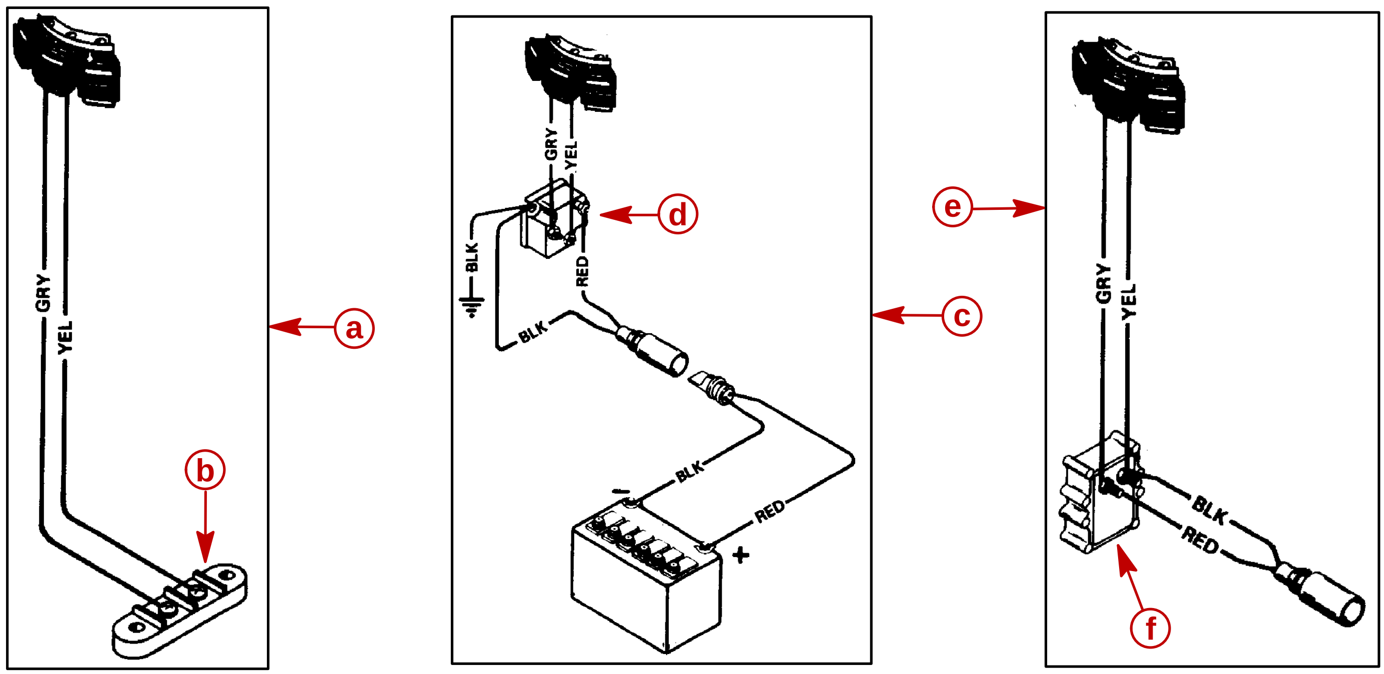
Electric Models Equipped with Remote Control (RED Stator) Model 20/25 (1999 and NEWER)



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

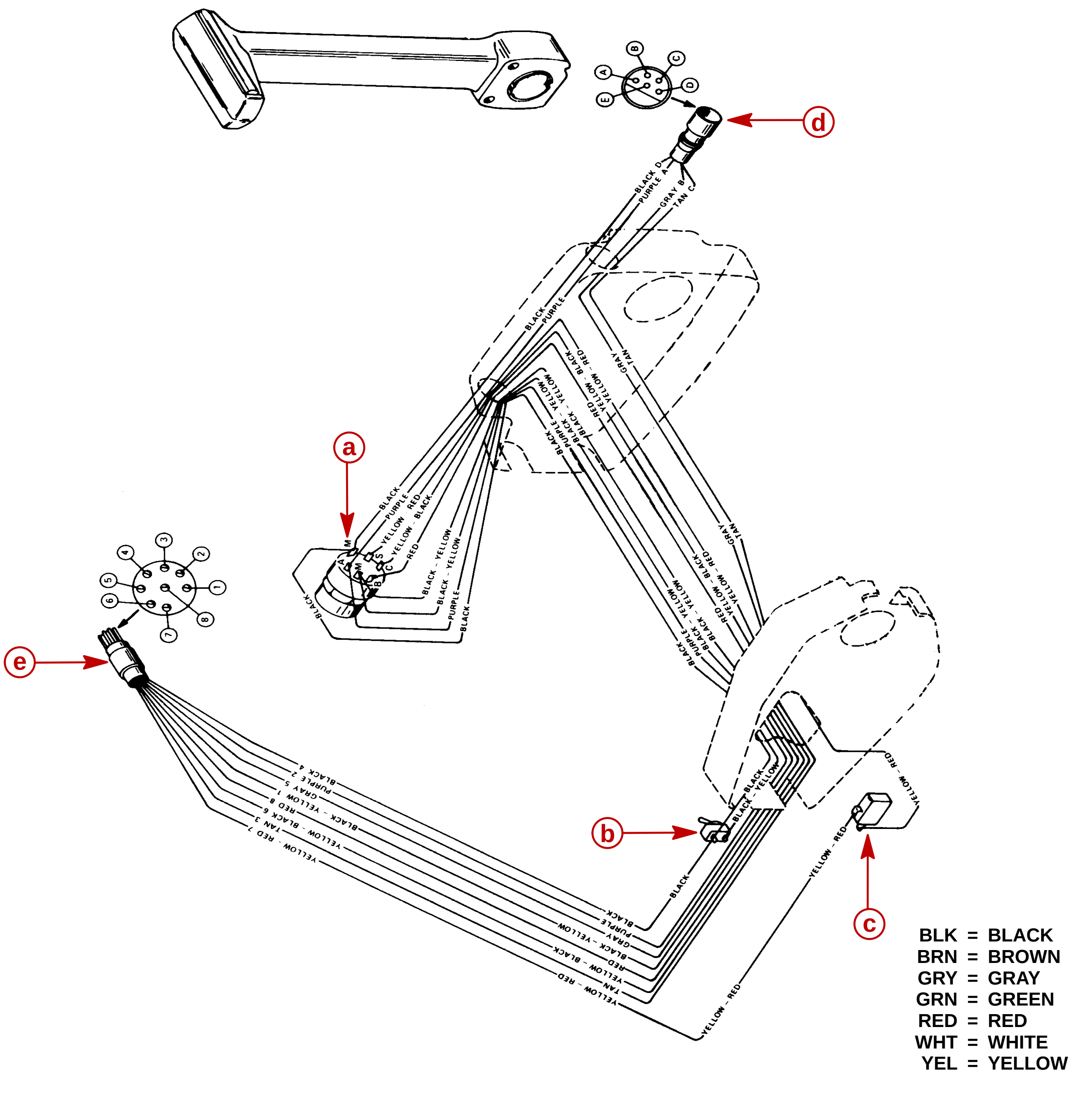
a - Stator
b - Trigger
c - Switch Box
d - Ignition Coil Bottom Cylinder
e - Ignition Coil Top Cylinder
f - Choke Solenoid
g - Remote Control Harness
h - Fuse Holder (20 Ampere Fuse)
i . - Rectifier
j . - Charging Coils
k - Starter Solenoid
l . - 12 VDC Battery
m - Starter Motor

Optional Electrical Accessories Wiring Diagrams



a - Manual Start Model with Lighting Coil and Unregulated AC Voltage
b - Terminal Block
c - Manual Start Model with Battery Charging Kit
d - Rectifier
e - Manual Start Model with Voltage Regulator
f - Voltage Regulator

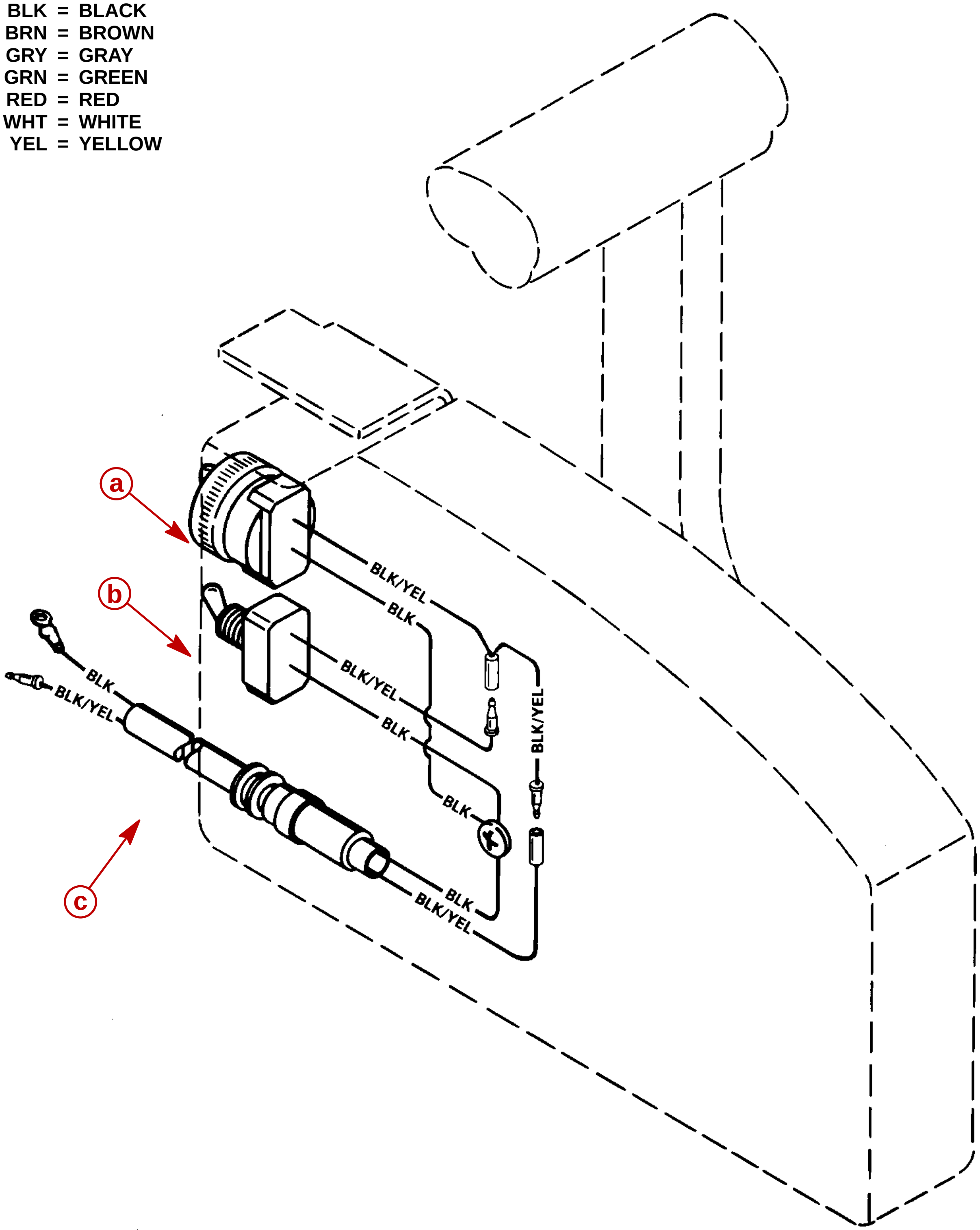
Commander Remote Control (Electric Start)



a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Remote Control Harness Connector

Commander 2000 Remote Control (Manual)

BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW



a - RUN – OFF Switch
b - Emergency Stop Switch
c - Stop Switch Harness

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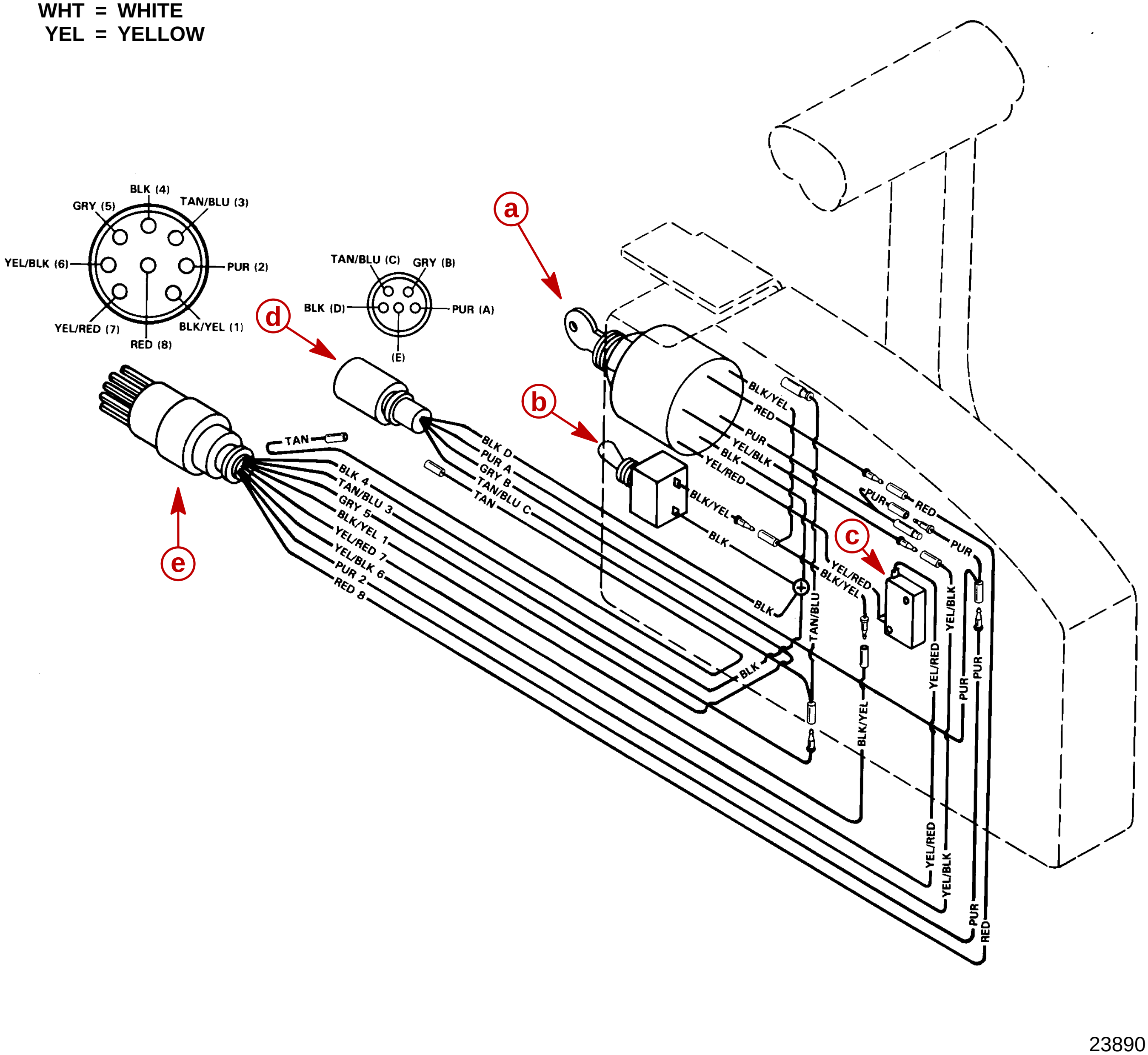
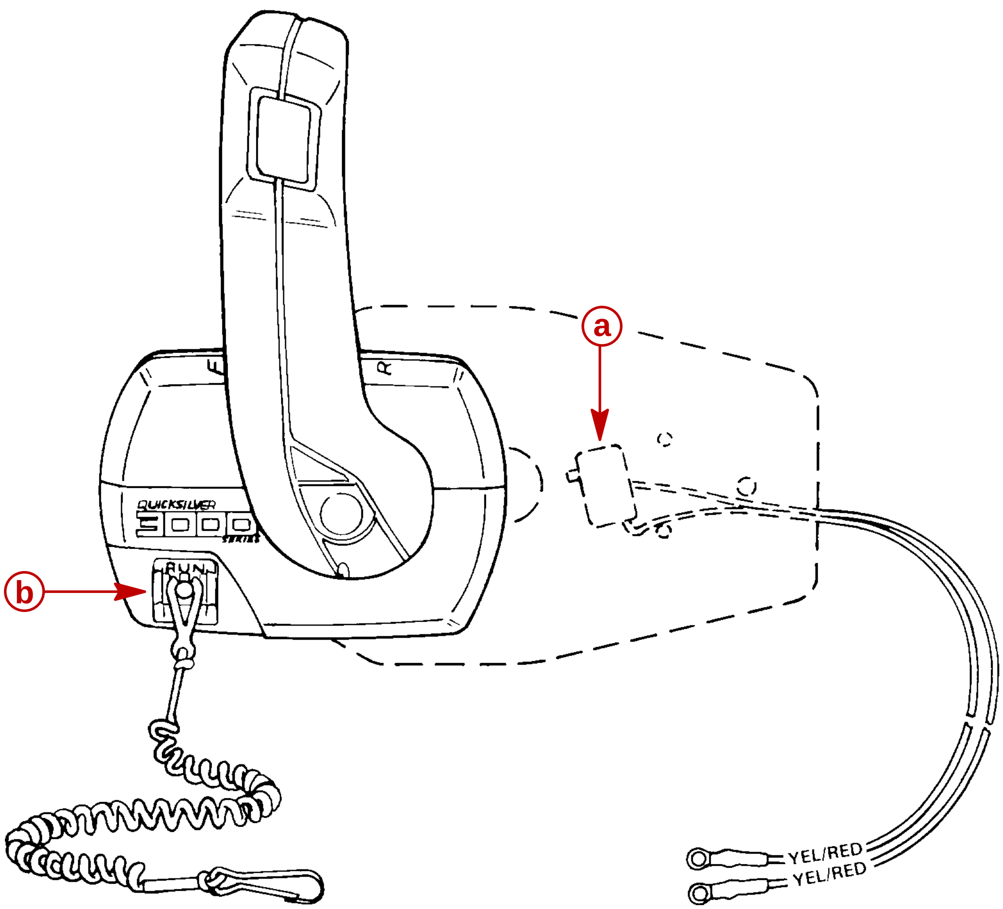
Commander 2000 Remote Control (Electric Start)

BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW



a - Ignition/Choke Switch
b - Emergency Stop Switch
c - Neutral Start Switch
d - Tachometer/Accessories Harness Connector
e - Wiring Harness Connector

Commander 3000 Panel Mount Control



BLK = BLACK
BRN = BROWN
GRY = GRAY
GRN = GREEN
RED = RED
WHT = WHITE
YEL = YELLOW

a - Neutral Interlock Switch
b - Emergency Stop Switch

FUEL SYSTEM

Section 3A - Carburetor/Fuel Pump

Table of Contents

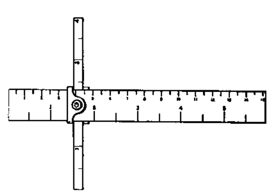
3
A

Specifications

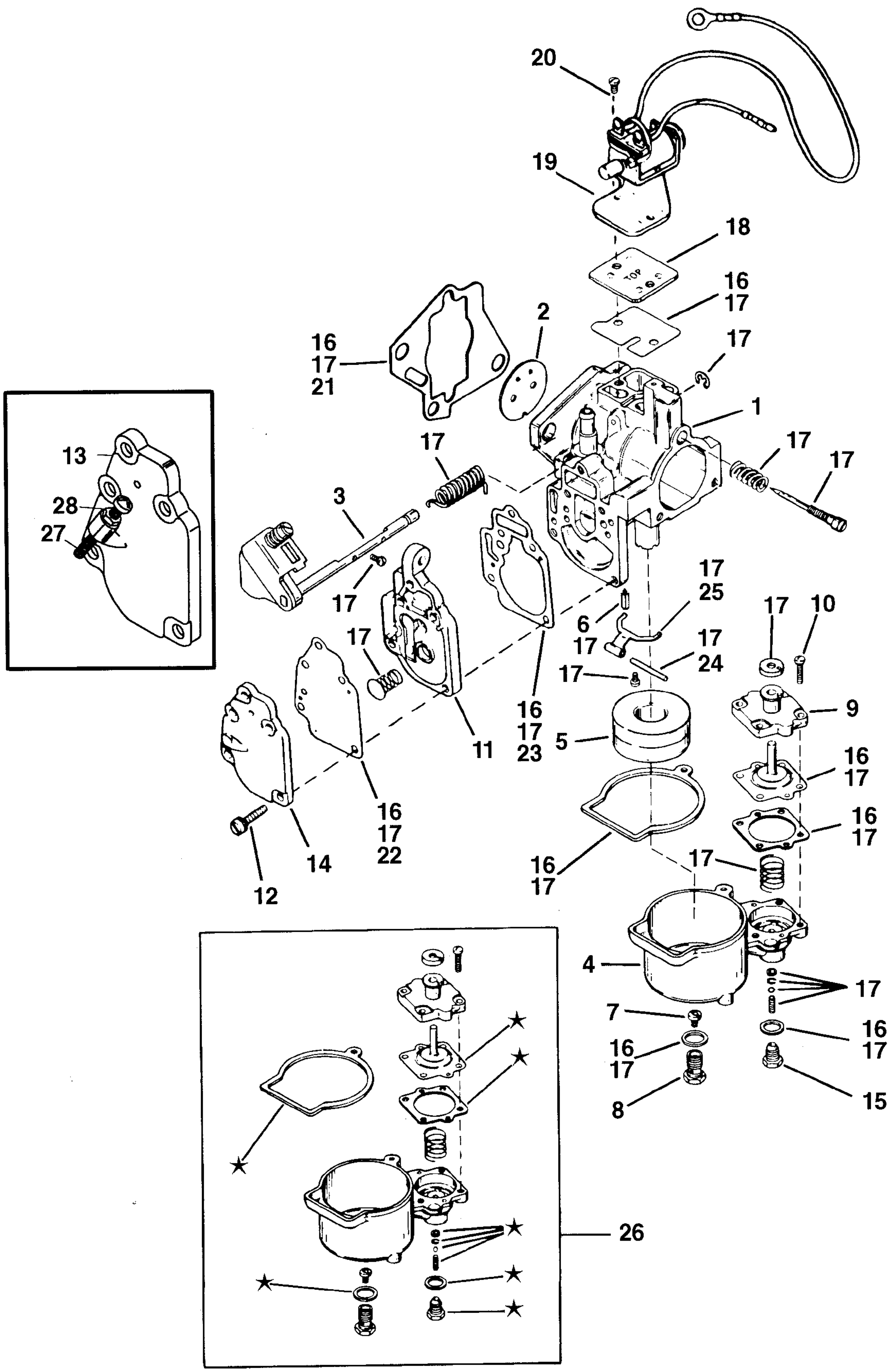
CARBURETOR SPECIFI-CATIONS	**Idle RPM (In Forward Gear)**	750 ± 50
	Wide Open Throttle (WOT) RPM	
	20	4500 - 5500
	25	5000 - 6000
	Idle Mixture Screw Adjustment (Preset-Turns Out)	
	20	1 ± 1/4 Turn
	20 Jet	1-1/2 ± 1/2 Turn
	25/25 Seapro/25 Marathon	1-1/4 ± 1/4 Turn
	Float Level	1.0 in. (25.4 mm)
	Main Jet Size	
	1994$^1/_2$ thru 1996	
	-20 (WMC-44)	0.044 in. (1.12 mm)
	-25/20 Jet (WMC-45)	0.076 in. (1.93 mm)
	-25 Seapro/Marathon (WMC-46)	0.076 in. (1.93 mm)
	-25 Seapro/Marathon (WMC-46A)	0.080 in. (2.03 mm)
	1997 and Newer	
	-20 Jet (WMC-45)	0.076 in. (1.93 mm)
	-20 (WMC-52)	0.044 in. (1.12 mm)
	-25 (WMC-53)	0.076 in. (1.93 mm)
	-25 Seapro/Marathon (WMC-54)	0.080 in. (2.03 mm)

Special Tools

1. Carburetor Scale



Carburetor (20/25/JET 20)

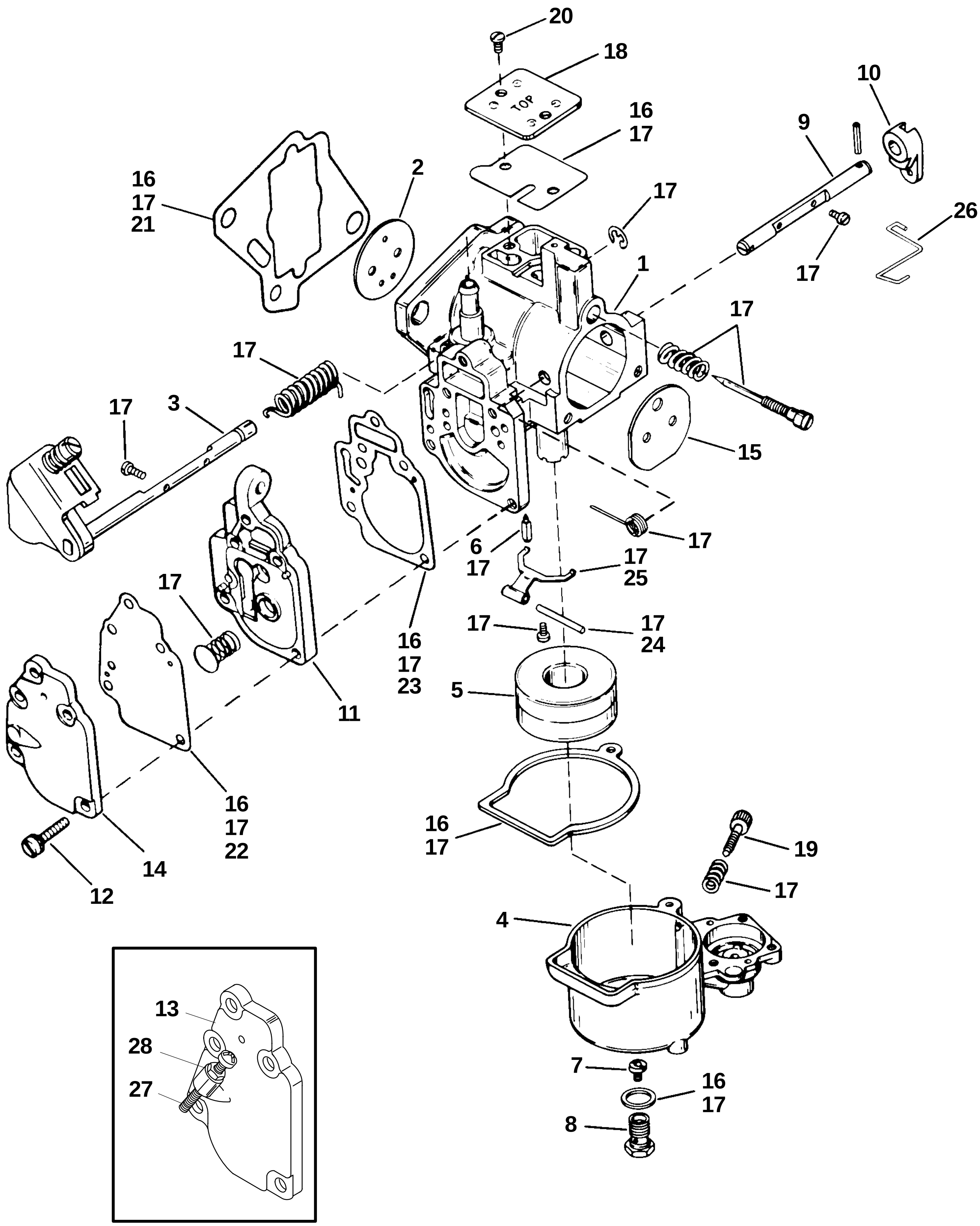


★= CONTENTS OF PRIMER/INJECTOR KIT, PART NO. 1395-9844A1, REFERENCE NO. 26

Carburetor (20/25/JET 20)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	CARBURETOR **(WMC-52 - 20HP)**			
	1	CARBURETOR **(WMC-53 - 25HP)**			
	1	CARBURETOR **(WMC-44 - 20HP)**			
	1	CARBURETOR **(WMC-45 - 25HP)(JET 20)**			
2	1	THROTTLE VALVE **(20HP)**			
	1	THROTTLE VALVE **(25HP/JET 20)**			
3	1	THROTTLE SHAFT **(20-WMC-44)**			
	1	THROTTLE SHAFT **(25-WMC-45)(JET 20)**			
		THROTTLE SHAFT**(20/25HP)(WMC52/52A/53/53A)**			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	VALVE–inlet needle			
7	1	JET–main fuel **(.044 - 20HP)**			
	1	JET–main fuel **(.076- 25HP/JET 20)**			
8	1	PLUG–jet retainer	32		3.6
9	1	COVER–diaphragm			
10	4	SCREW–diaphragm cover	14		1.6
11	1	BODY–fuel pump			
12	5	SCREW–fuel pump cover	18		2.0
13	1	COVER–fuel pump			
14	1	COVER–fuel pump **(JET 20)**			
15	1	PLUG	32		3.6
16	**1**	**GASKET/DIAPHRAGM KIT**			
17	**1**	**REPAIR PARTS KIT**			
18	1	PLATE–cover (MANUAL)			
19	1	ELECTRIC CHOKE (ELECTRIC)			
20	2	SCREW–cover plate	18		2.0
21	1	GASKET–carburetor			
22	1	DIAPHRAGM/GASKET			
23	1	GASKET			
24	1	FLOAT PIN			
25	1	FLOAT LEVER			
26	1	PRIMER/INJECTOR SERVICE KIT (See illustration for contents)			
27	1	SCREW			
28	1	NUT			

Carburetor (Seapro/Marathon 15/25 & Super 15)



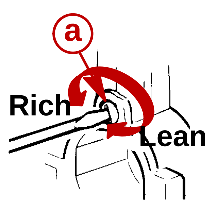
Carburetor (Seapro/Marathon 15/25 & Super 15)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	CARBURETOR **(WMC-54)**			
	1	CARBURETOR **(WMC-46A)**			
	1	CARBURETOR **(WMC-56)**			
2	1	THROTTLE VALVE **(WMC–46/46A/54/54A)**			
	1	THROTTLE VALVE **(WMC-56/56A)**			
3	1	THROTTLE SHAFT			
4	1	FUEL BOWL			
5	1	FLOAT			
6	1	VALVE–inlet needle			
7	1	JET–main fuel (.076) **(WMC–46)**			
	1	JET–main fuel (.080) **(WMC–46A/54/54A)**			
	1	JET–main fuel (.046) **(WMC–56/56A)**			
8	1	PLUG–jet retainer	32		3.6
9	1	CHOKE SHAFT			
10	1	CHOKE LEVER			
11	1	BODY–fuel pump			
12	5	SCREW–fuel pump cover	18		2.0
13	1	COVER–pump **(WMC-54/54A/56/56A)**			
14	1	COVER–fuel pump **(WMC-46/46A)**			
15	1	CHOKE VALVE			
16	**1**	**GASKET/DIAPHRAGM KIT**			
17	**1**	**REPAIR PARTS KIT**			
18	1	PLATE–cover			
19	1	SCREW–bowl drain	14		1.6
20	2	SCREW–cover plate	18		2.0
21	1	GASKET–carburetor			
22	1	DIAPHRAGM/GASKET			
23	1	GASKET			
24	1	FLOAT PIN			
25	1	FLOAT LEVER			
26	1	CHOKE LINK			
27	1	SCREW			
28	1	NUT			

Carburetor Adjustments

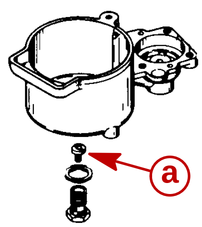
Carburetor Number Stamped at Top of Carburetor Mounting Flange						
Carburetor Number	Model H.P.	Main Jet Size	Bowl Vent Jet	Back Drag Jet	Float Setting	Pre-Set Idle Mixture Screw (Open)
WMC - 43 Commercial	25	.080	None	None	1.0 in. (25.4 mm)	1-1/2 Turns
WMC - 44	20	.044	None	None	1.0 in. (25.4 mm)	1-1/2 Turns
WMC - 52	20	.044	None	None	1.0 in. (25.4 mm)	1-1/2 Turns
WMC - 53 WMC - 53A	25	.076	None	None	1.0 in. (25.4 mm)	1-1/2 Turns
WMC - 54 Commercial	25	.080	None	None	1.0 in. (25.4 mm)	1-1/2 Turns

Low Speed Mixture Screw



a - Low Speed Mixture Screw

Main Jet



a - Main Jet

High Altitude High Speed Jetting			
Altitude	Main Jet		
	20	25	SeaPro/Marathon
0 - 5000 ft. (0 - 1524m)	.044 in.*	.076 in.*	.080 in.*
5000 - 7500 ft. (1524 - 2286m)	.042 in.	.074 in.	.078 in.
7500 - 10000 (2286 - 3048m)	.040 in.	.072 in.	.076 in.

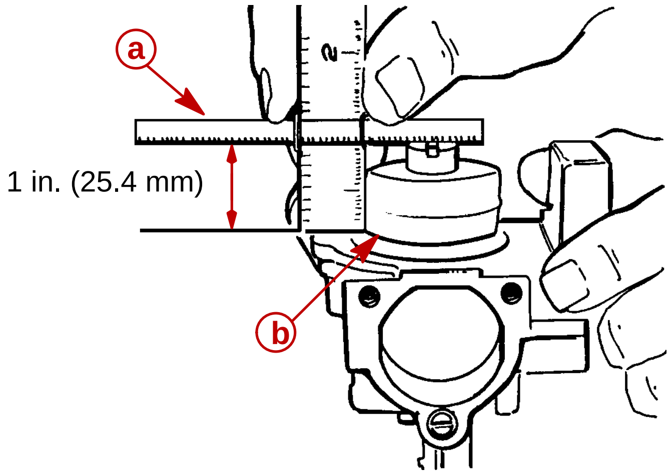
*Standard Main Jet

High Altitude Jet Chart

Factory installed main fuel jets are normally adequate for proper performance up to approximately 5000 feet (1524m) above sea level. Between 2000 feet (609.6m) and 5000 feet (1524m) the reduction of the main fuel jet(s) may result in improved performance and fuel economy. Above 5000 feet, however, it is recommended that main jet size be reduced as shown per 1000 feet (304.8m) in the following chart. RETURN TO LOWER ELEVATION: Carburetor jet changes must be reversed to avoid a lean fuel condition when used at low elevation.

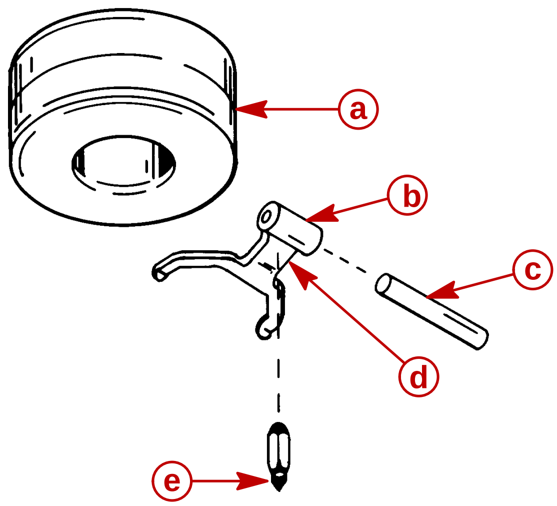
Feet Meter	1000 304.8	2000 609.6	3000 914.4	4000 1219.2	5000 1524	6000 1828.8	7000 2133.6	8000 2438.4	9000 2743.2	10000 3048	1100033 52.8	12000 3657.6
Jet Size												
0.034	0.034	0.034	0.032	0.032	0.032	0.032	0.032	0.032	0.030	0.030	0.030	0.030
0.036	0.036	0.036	0.034	0.034	0.034	0.034	0.034	0.032	0.032	0.032	0.032	0.032
0.038	0.038	0.038	0.036	0.036	0.036	0.036	0.036	0.034	0.034	0.034	0.034	0.034
0.040	0.040	0.040	0.038	0.038	0.038	0.038	0.038	0.036	0.036	0.036	0.036	0.034
0.042	0.042	0.042	0.040	0.040	0.040	0.040	0.038	0.038	0.038	0.038	0.038	0.036
0.044	0.044	0.044	0.042	0.042	0.042	0.042	0.040	0.040	0.040	0.040	0.038	0.038
0.046	0.046	0.046	0.044	0.044	0.044	0.044	0.042	0.042	0.042	0.042	0.040	0.040
0.048	0.048	0.048	0.046	0.046	0.046	0.046	0.044	0.044	0.044	0.042	0.042	0.042
0.050	0.050	0.050	0.048	0.048	0.048	0.046	0.046	0.046	0.046	0.044	0.044	0.044
0.052	0.052	0.050	0.050	0.050	0.050	0.048	0.048	0.048	0.048	0.046	0.046	0.046
0.054	0.054	0.052	0.052	0.052	0.052	0.050	0.050	0.050	0.048	0.048	0.048	0.048
0.056	0.056	0.054	0.054	0.054	0.054	0.052	0.052	0.052	0.050	0.050	0.050	0.048
0.058	0.058	0.056	0.056	0.056	0.056	0.054	0.054	0.054	0.052	0.052	0.052	0.050
0.060	0.060	0.058	0.058	0.058	0.056	0.056	0.056	0.054	0.054	0.054	0.052	0.052
0.062	0.062	0.060	0.060	0.060	0.058	0.058	0.058	0.056	0.056	0.056	0.054	0.054
0.064	0.064	0.062	0.062	0.062	0.060	0.060	0.060	0.058	0.058	0.058	0.056	0.056
0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.062	0.060	0.060	0.060	0.058	0.058
0.068	0.068	0.066	0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.060	0.060	0.060
0.070	0.070	0.068	0.068	0.068	0.066	0.066	0.064	0.064	0.064	0.062	0.062	0.062
0.072	0.072	0.070	0.070	0.070	0.068	0.068	0.066	0.066	0.066	0.064	0.064	0.062
0.074	0.074	0.072	0.072	0.070	0.070	0.070	0.068	0.068	0.068	0.066	0.066	0.064
0.076	0.076	0.074	0.074	0.072	0.072	0.072	0.070	0.070	0.068	0.068	0.068	0.066
0.078	0.078	0.076	0.076	0.074	0.074	0.074	0.072	0.072	0.070	0.070	0.068	0.068
0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074	0.072	0.072	0.070	0.070
0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074	0.072	0.072
0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.076	0.074	0.074
0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076	0.076	0.074
0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078	0.078	0.076
0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080	0.080	0.078
0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082	0.082	0.080
0.094	0.094	0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086	0.084	0.084	0.082
0.096	0.096	0.094	0.094	0.092	0.092	0.090	0.090	0.088	0.086	0.086	0.084	0.084
0.098	0.098	0.096	0.096	0.094	0.092	0.092	0.090	0.090	0.088	0.088	0.086	0.086

Carburetor Float Adjustment



17111

a - Carburetor Scale (91-36392)
b - Measured from bottom of float

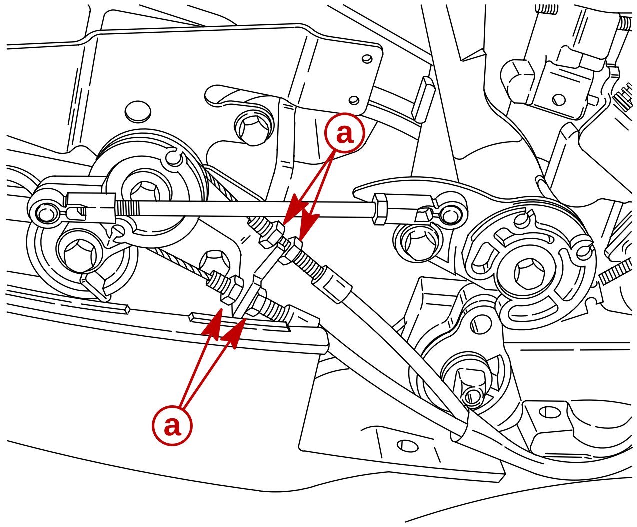


52646

a - Float
b - Float Hinge
c - Float Pin
d - Bend Float Arm Here to Adjust Float Level
e - Needle

Carburetor Adjustments

1. Place outboard in water.
2. Check tiller handle cable adjustment for full throttle movement in both "**Forward**" and "**Reverse**" gears. Adjust jam nuts for proper travel and to eliminate any slack.



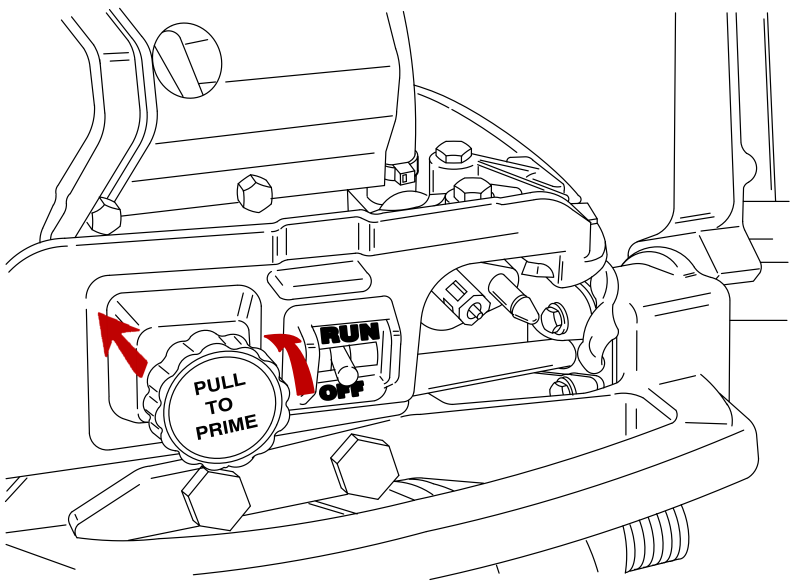
57049

a - Jam Nuts

INITIAL CARBURETOR ADJUSTMENTS

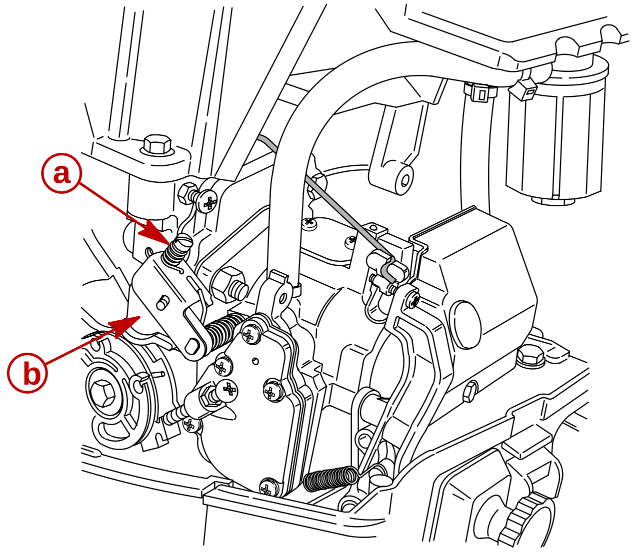
Idle Speed Screw (Models So Equipped)

1. Shift outboard to "**Neutral**" and place throttle twist grip to "**Slow**".
2. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.



57037

3. Back idle speed screw off of cam follower.
4. Turn idle speed screw inward (clockwise) until it “just touches” cam follower, then inward an additional 1/2 turn to slightly open throttle plate.

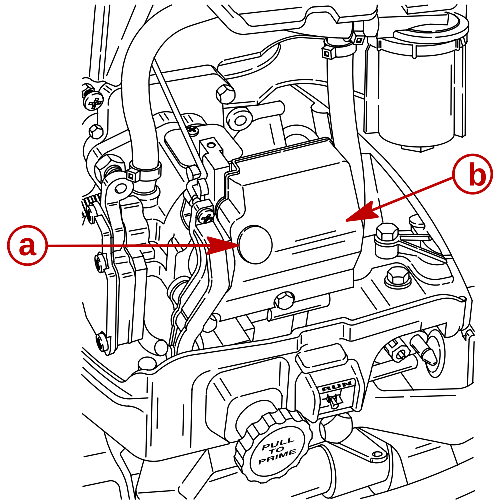


57070

a - Idle Speed Screw
b - Cam Follower

LOW SPEED MIXTURE SCREW

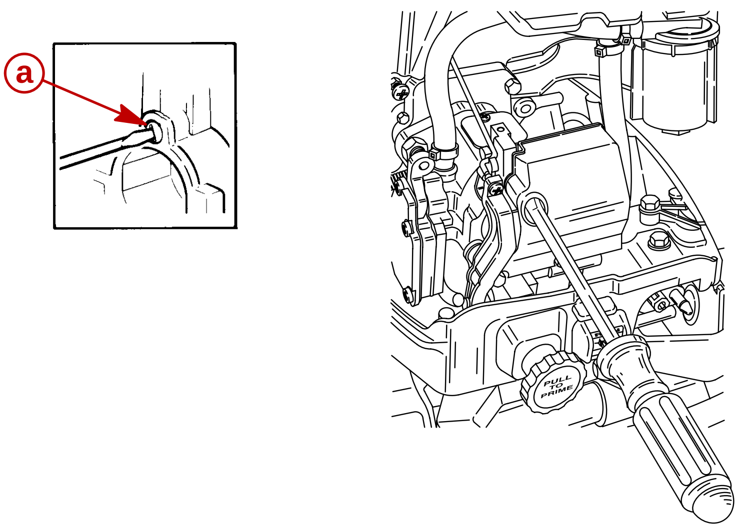
1. Remove access plug from carburetor air intake cover (models so equipped).



57072

a - Access Plug
b - Intake Cover

2. Turn low speed mixture screw slowly inward (clockwise) until it seats lightly, then back screw out (counterclockwise) 1–1/2 to 1–3/8 turns(turning mixture screw in tight will damage needle and seat).
3. Do not install access plug at this time.

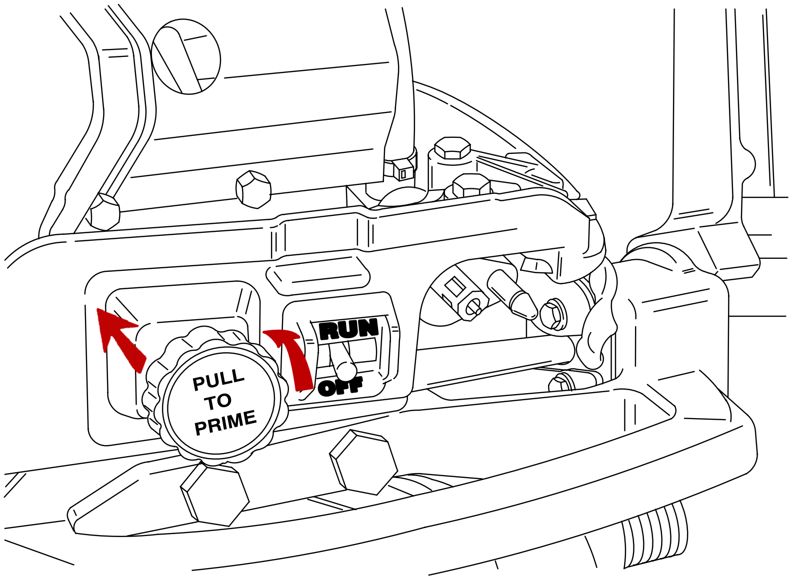


57071

a - Low Speed Mixture Screw

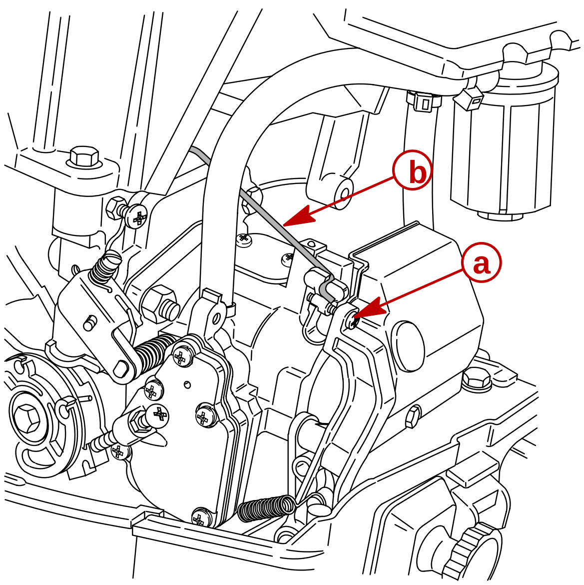
IDLE WIRE ADJUSTMENT

1. Push primer/fast idle knob completely in and rotate fully counterclockwise.
2. Shift engine to “**Neutral**”.



57037

3. Adjust screw (a) to remove all clearance between idle wire (b) and trigger.



57070

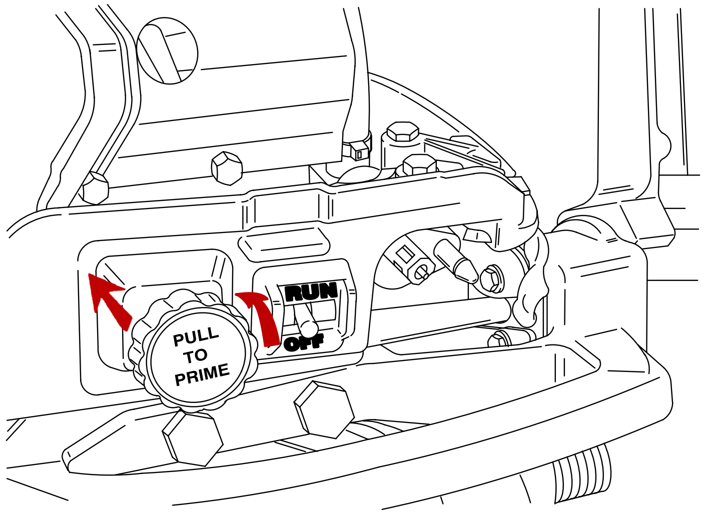
a - Screw
b - Idle Wire

4. Check fast idle speed by turning primer knob to full clockwise position. Fast idle speed should be 1500 – 2000 RPM.

IDLE ADJUSTMENT

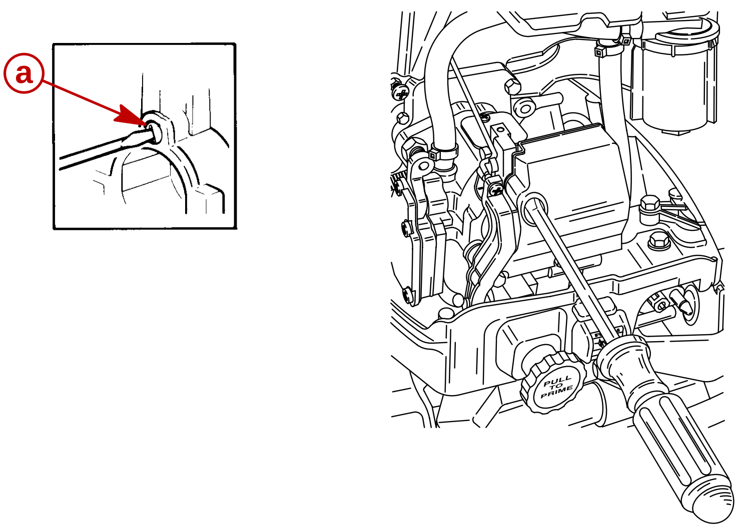
Low speed Mixture Adjustment

1. Start engine and allow to warm up (run for several minutes). Throttle engine back to idle for about one minute to allow RPM to stabilize.
2. Push primer/fast idle knob completely in and rotate knob fully counterclockwise.



57037

3. With engine running at idling speed while in **"Forward"** gear, turn low speed mixture screw counterclockwise until engine starts to "load up" or fire unevenly from over–rich mixture.
4. Slowly turn low speed mixture screw clockwise until cylinders fire evenly and engine picks up speed.



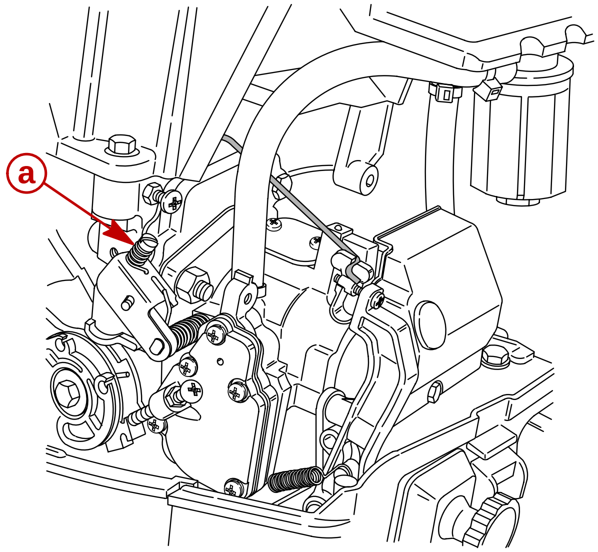
57071

a - Low Speed Mixture Screw

5. Continue turning mixture screw clockwise until too lean a mixture is obtained and engine slows down and misfires.
6. Set low speed mixture screw halfway between rich and lean.
7. DO NOT adjust leaner than necessary to attain reasonably smooth idling. When in doubt, set mixture slightly richer rather than too lean.
8. Check for freedom from 4–cycling between idle and 2000 RPM (in **"Forward"** gear).
9. Install access plug into opening in carburetor air intake cover.

IDLE SPEED ADJUSTMENT (MODELS EQUIPPED WITH IDLE SCREW)

1. With engine running at idle in **“Forward”** gear, make sure primer/fast idle knob is pushed completely in and rotate fully counterclockwise to stop.
2. Adjust idle speed screw (a) to obtain recommended idle speed (see specifications).



57070

a - Idle Speed Screw

IDLE SPEED ADJUSTMENT (MODELS NOT EQUIPPED WITH AN IDLE SPEED SCREW)

For models not equipped with an idle speed screw, the carburetor has been calibrated at the factory to maintain an idle speed of 650 ± 75 RPM in “**Forward**” gear.

Fuel System Troubleshooting

General Information

Problems that are thought to be caused by the fuel system may, in reality, be something completely different. Items, that are shown in the list on the right, could give the impression that there is a problem in the fuel system.

1. Propeller
2. Spark Plugs
3. Ignition Timing
4. Ignition Spark Voltage
5. Cylinder Compression
6. Reed Valves

Typical symptoms and solutions in troubleshooting a fuel system are shown below:

Problem: Engine Turns Over but Will Not Start or Starts Hard When Cold
Problem: Engine Idles Rough and Stalls.
Problem: Engine Runs Uneven or Surges.
Problem: Engine Will Not Accelerate.

Possible Cause	Corrective Action
Improper starting procedure used.	Review starting procedure as outlined in “Operation and Maintenance Manual.”
Fuel tank empty or too low. Improperly mixed fuel. Contaminants (water,dirt, etc.) in fuel.	Check fuel in tank and replace or add whichever is necessary.
Fuel tank air vent closed or restricted.	Check air vent on fuel tank. Air vent must be open all-the-way and free from any contaminants.
Pinched, cut, restricted fuel line or loose fuel line connection.	Inspect all fuel lines and replace as needed. Tighten fuel line connections.
Dirty or restricted fuel filter.	Inspect and replace or clean all fuel filters.
Choke solenoid or enrichment valve not operating.	Inspect solenoid or valve and wiring. Replace as required.
Needle and seat in carburetor that is either stuck open (flooding) or closed (no fuel).	Refer to carburetor disassembly in this section.
Improper carburetor jet, restricted jet or idle mixture screw out of adjustment.	Refer to carburetor adjustments in this section.
Improper float level.	Refer to carburetor adjustments in this section.
Low fuel pump pressure.	Disassemble and inspect fuel pump components.
Defective anti-siphon valve.	Inspect valve and/or test engine without valve in fuel system.

Possible Cause	Corrective Action
Improperly mixed fuel. Contaminants(water, dirt, etc.) in fuel.	Check fuel in tank and replace if necessary.
Fuel tank air vent closed or restricted.	Check air vent on tank. Vent must be open all-the-way and free from any contaminants.
A pinched, cut or restricted fuel line. Also loose fuel line connection.	Inspect all fuel lines and replace as needed. Inspect and tighten all fuel line connections.
Dirty or restricted fuel filter.	Inspect and replace or clean all fuel filters.
Low fuel pump pressure.	Disassemble and inspect fuel pump components.
Defective anti-siphon valve.	Inspect valve and/or test engine without valve in fuel system.
Needle and seat in carburetor that is either stuck open or closed.	Refer to carburetor adjustments in this section.
Improper carburetor jet, restricted jet or idle mixture screw out of adjustment.	Refer to carburetor adjustments in this section.
Improper float level.	Refer to carburetor adjustments in this section.
Carburetor loose on intake manifold.	Check tightness of carburetor nuts.
Reed block loose or gasket defective.	Using a pressure oil can, apply 2-cycle oil around reed block housing/crankcase housing matching surfaces and carburetor base. If engine RPM changes, tighten bolts/nuts or replace gaskets as required.
Improperly routed or restricted bleed hose(s).	Refer to bleed hose routing in “Powerhead” section.
Damaged fuel pump diaphragm.	Disassemble and inspect fuel pump components.
Carburetor mixing chamber cover leaking air.	Tighten screws or replace gasket.
Off idle holes plugged.	Blow with compressed air.
Main nozzle or idle nozzle air bleed holes plugged.	Blow with compressed air.
Damaged reeds.	Refer to Section 4 for reed inspection.
Fuel pick-up outlet tube in fuel tank cracked.	Replace
Wrong spark plug or improper spark plug gap	Install correct plug or readjust gap.
Improper spark timing.	Reset timing to correct specifications.

Problem: Engine Floods	
Possible Cause	**Corrective Action**
Dirt or debris are preventing inlet needle from seating.	Flush out inlet seat and clean inlet needle.
Worn inlet needle.	Replace
Punctured float	Replace.
Incorrect float setting	Reset float.

Problem: Engine Runs Too Rich	
Possible Cause	**Corrective Action**
Fuel level too high.	Reset float to correct level.
Carburetor floods.	See preceding “Engine Floods.”
Idle nozzle air holes plugged.	Blow out with compressed air.
Restricted air flow.	Inspect cowl air inlet and carburetor for obstructions.
Main fuel jet loose.	Retighten jet.

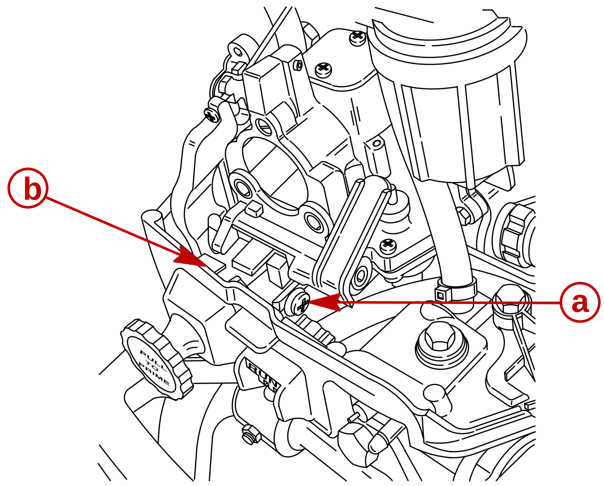
Problem: Fuel Blowback Out of Carburetor Problem: Unable to Reduce Engine RPM to Slow Idle	
Possible Cause	**Corrective Action**
Chipped or broken reeds on reed block.	Replace reeds.
Problem: Rough Idle	
Possible Cause	**Corrective Action**
Excessive preload on reeds.	Replace reeds.

Problem: Engine Runs Too Lean	
Possible Cause	**Corrective Action**
Carburetor is loose. Air leaks past mixing chamber cover.	Tighten bolts securely. Tighten cover or replace gasket.
Fuel level is too low.	Reset float level.
Clogged high speed jet.	Inspect jet for varnish or debris and clean.
Restricted fuel flow to carburetor.	Check fuel lines and filter(s) for restricted flow.
Incorrect high speed jet.	Refer to main jet chart and replace with proper jet.
Idle mixture set too lean.	Adjust to run richer (turn idle mix screw counterclockwise).
Air leakage into fuel system.	Inspect fuel line connections, hose clamps, fuel pump and fuel outlet tube (located in fuel tank) for loose fittings.
Anti-siphon valve restricting fuel flow.	Inspect valve and/or test engine without valve in fuel system.

Carburetor Removal

NOTE: *Air intake cover has been removed for visual clarity.*

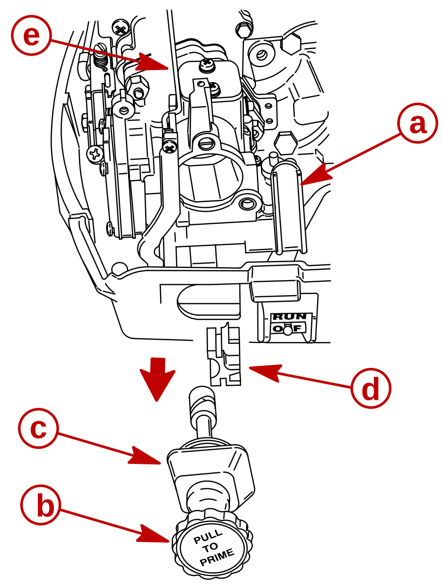
1. Loosen primer cam retaining screw.
2. Remove retaining clip.



57069

a - Screw
b - Retaining Clip

3. Push down on primer arm and pull primer knob, bezel and slide block out of bottom cowl.
4. Remove link wire from fast idle lever.
5. Disconnect fuel line from carburetor.
6. Remove carburetor mounting nuts.
7. Lift carburetor from engine.

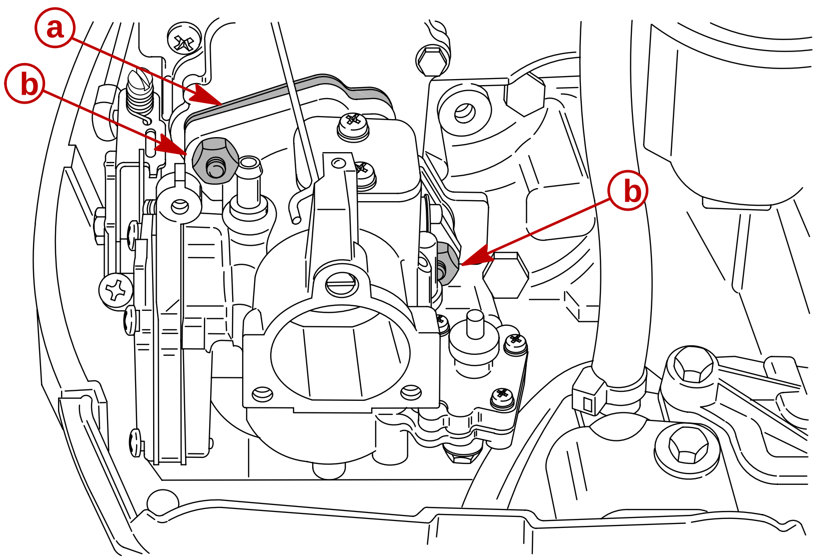


57068

a - Primer Arm
b - Primer Knob
c - Bezel
d - Slide Block
e - Link Wire

Carburetor Installation

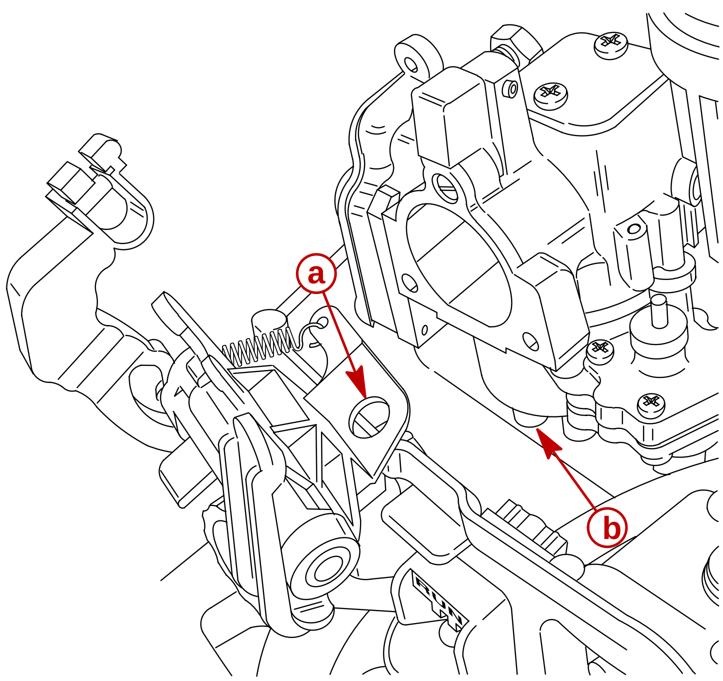
1. Install carburetor with new gasket onto mounting studs. Start attaching nuts but do not tighten.



57067

a - Gasket
b - Nuts

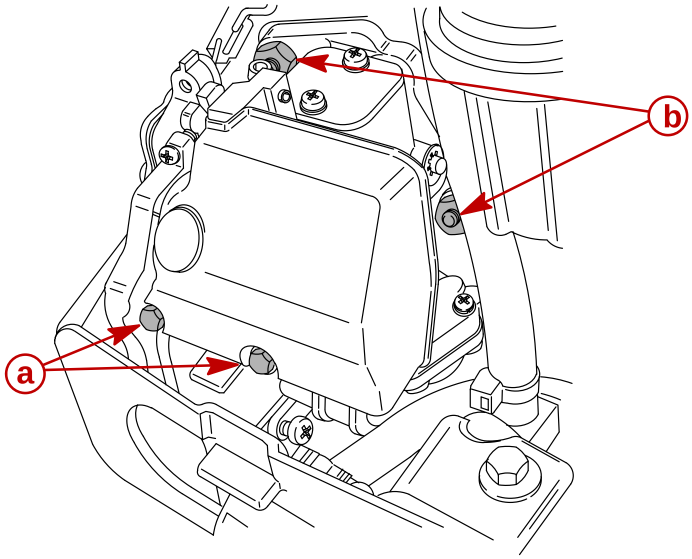
2. Install primer assembly onto carburetor. Position alignment hole on assembly over post on bottom of carburetor.



57066

a - Alignment Hole
b - Post

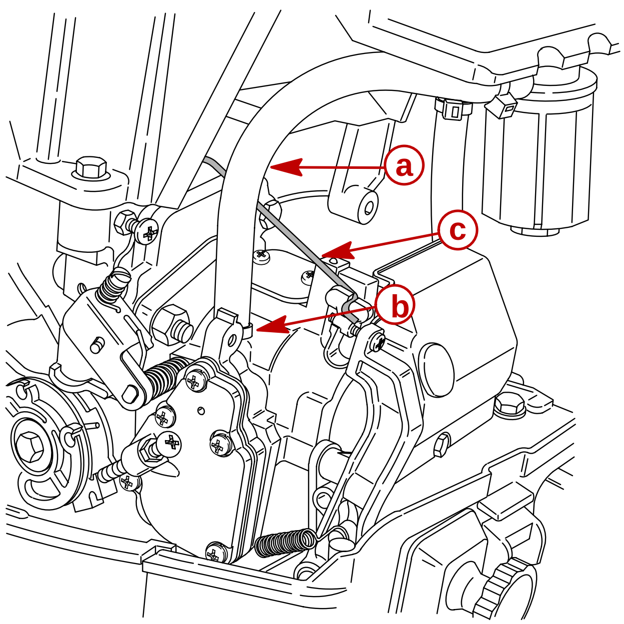
3. Install air cover onto carburetor and secure with 2 screws.
4. Tighten carburetor attaching nuts.



57075

a - Screws
b - Nuts

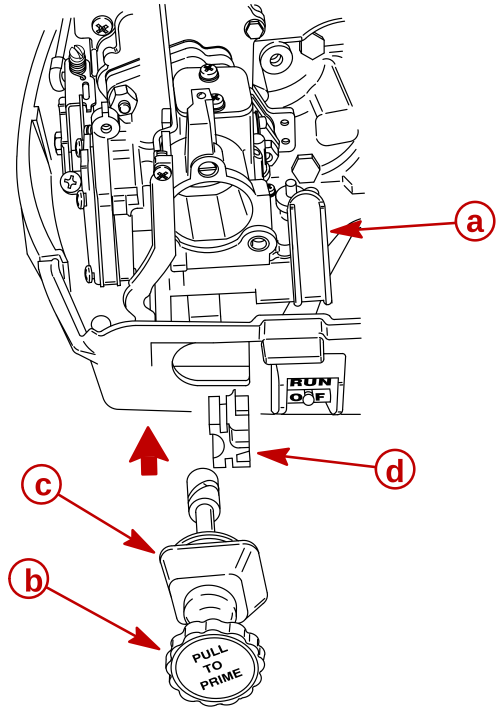
5. Secure fuel line to carb with sta-strap.
6. Reconnect link wire to fast idle lever.



57070

a - Fuel Line
b - Sta-strap
c - Link Wire

7. Push down on primer arm and insert primer knob, bezel and slide block into primer assembly.

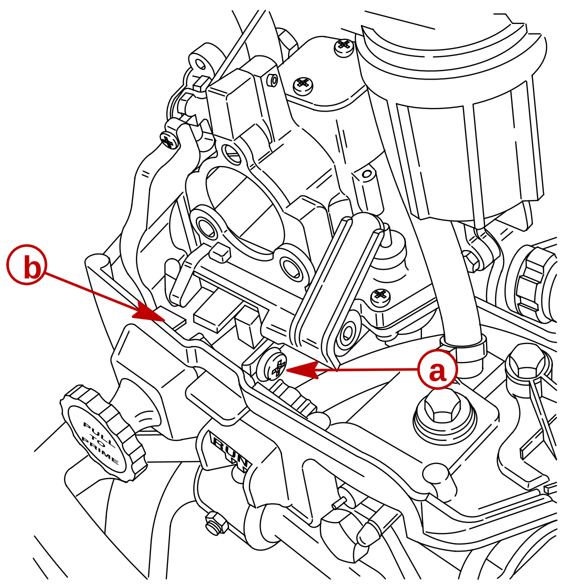


57068

a - Primer Arm
b - Primer Knob
c - Bezel
d - Slide Block

8. Tighten screw to secure slide block in place.

9. Align notch in back side of bezel with tab on bottom cowl and secure bezel in place with retaining clip.



57069

a - Screw
b - Retaining Clip

Fuel Pump

Removal and Disassembly

IMPORTANT: Fuel pump check valve diaphragm and gasket should NOT be re-used once the fuel pump is disassembled.

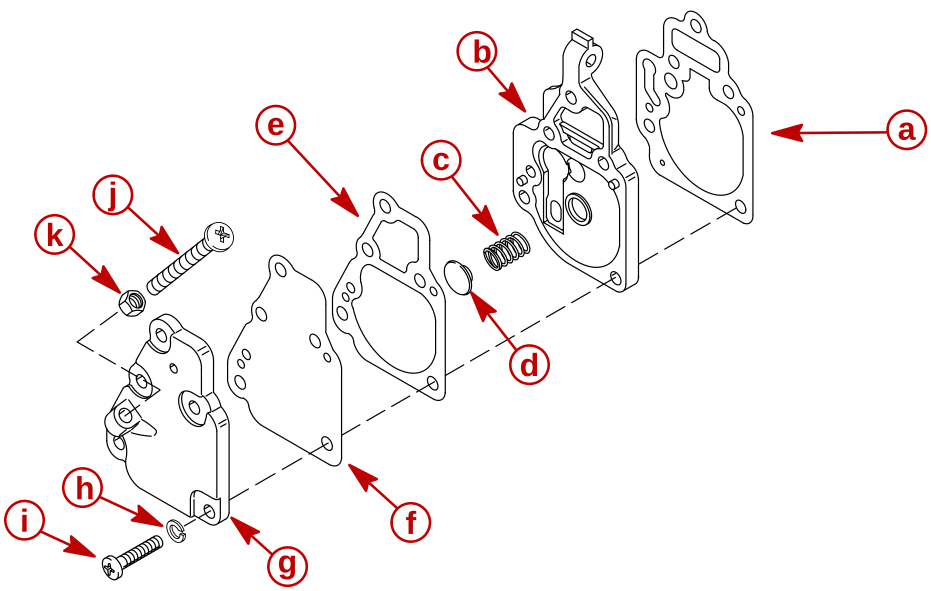
1. Remove 5 screws securing fuel pump assembly to carburetor.
2. Separate fuel pump components.

Cleaning and Inspection

1. Clean and dry all parts thoroughly.
2. Inspect pump body and base on carburetor for nicks, cracks or rough gasket surface.
3. Inspect pump check valve diaphragm. Diaphragm MUST BE flat and free from holes and imperfections.
4. Pump body surface below check valves MUST BE flat so that check valve will seat.

Reassembly and Installation

1. Inspect all parts for serviceability.
2. Reassemble fuel pump.
3. Secure fuel pump assembly to carburetor with 5 screws. Torque screws to 18 lb. in. (3.2 N·m).



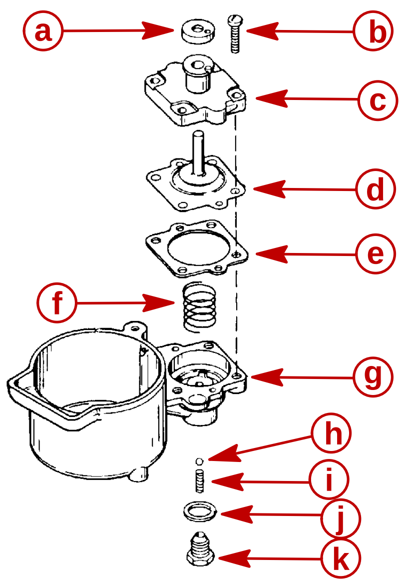
a - Gasket
b - Pump Body
c - Spring
d - Cap
e - Gasket
f - Diaphragm
g - Pump Cover
h - Lock Washer (5)
i - Screw (5) [Torque screws to 18 lb. in. (3.2 N·m)]
j - Idle Timing Screw
k - Nut

Primer System

The primer system provides extra fuel to the outboard whenever the primer knob is pulled out. The primer system components should be inspected carefully for serviceability. The diaphragm and gaskets should be inspected for cuts or abrasions. Replace accordingly. The primer check ball and springs should be inspected for debris or varnish which restrict free movement.

SYMPTOMS OF A DEFECTIVE PRIMER SYSTEM

1. Outboard is hard to start.
    a. Diaphragm is cut.
    b. Primer check ball is stuck in the closed position.
    c. Primer passage is plugged with debris or varnish.
2. Outboard smokes excessively at idle.
    a. Primer check ball is not seated due to debris, varnish or damaged check ball spring.



a - Seal
b - Screw (4) [Torque to 14 lb. in. (1.6 N·m)]
c - Cover
d - Diaphragm
e - Gasket
f - Spring
g - Primer Bowl
h - Check Ball
i - Spring
j - Gasket
k - Plug

Servicing Sight Bowl Fuel Filter

⚠ WARNING

Exercise extreme caution when cleaning fuel filter elements. Gasoline is extremely flammable and highly explosive under certain conditions. Always stop the engine and DO NOT smoke or allow open flames in the area while cleaning fuel filter elements.

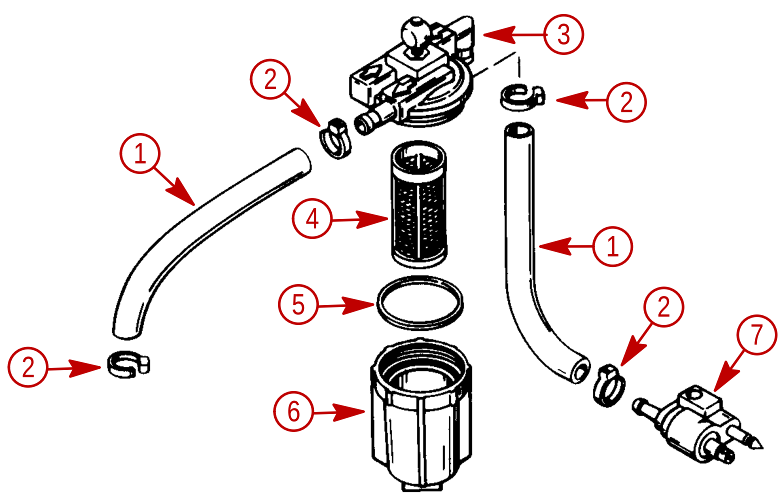
⚠ CAUTION

DO NOT turn or cock fuel filter assembly when removing or installing. PULL STRAIGHT DOWN when removing assembly. PUSH STRAIGHT UP when installing assembly. Turning or cocking fuel filter may break fuel line connection on filter.

The sight bowl fuel filter removes dirt and water from the fuel.

Check the sight bowl frequently and clean the filter as required.

1. Verify that the sight bowl rubber sealing ring is properly positioned in the bowl.
2. Reinstall element in filter cover.
3. Thread sight bowl onto filter cover.
4. Tighten bowl securely by hand.



1 - Fuel Line
2 - Sta-strap (4)
3 - Cover
4 - Filter
5 - Rubber Sealing Washer
6 - Sight Bowl
7 - Fuel Line Connector

FUEL SYSTEM

Section 3B - Emissions

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Exhaust Emissions Standards

Through the Environmental Protection Agency (EPA), the federal government has established exhaust emissions standards for all new marine engines sold in the U.S.

What Are Emissions?

Emissions are what comes out of the exhaust system in the exhaust gas when the engine is running. They are formed as a result of the process of combustion or incomplete combustion. To understand exhaust gas emissions, remember that both air and fuel are made of several elements. Air contains oxygen and nitrogen among other elements; gasolene contains mainly hydrogen and carbon. These four elements combine chemically during combustion. If combustion were complete, the mixture of air and gasoline would result in these emissions: water, carbon dioxide and nitrogen, which are not harmful to the environment. But combustion is not usually complete. Also, potentially harmful gases can be formed during and after combustion.

All marine engines must reduce the emission of certain pollutants, or potentially harmful gases, in the exhaust to conform with levels legislated by the EPA. Emissions standards become more stringent each year. Standards are set primarily with regard to three emissions: hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NOx).

Hydrocarbons – HC

Gasoline is a hydrocarbon fuel. The two elements of hydrogen and carbon are burned during combustion in combination with oxygen. But they are not totally consumed. Some pass through the combustion chamber and exit the exhaust system as unburned gases known as hydrocarbons.

Carbon Monoxide – CO

Carbon is one of the elements that make up the fuel burned in the engine along with oxygen during the combustion process. If the carbon in the gasoline could combine with enough oxygen (one carbon atom with two oxygen atoms), it would come out of the engine in the form of carbon dioxide (CO_2). CO_2 is a harmless gas. But carbon often combines with insufficient oxygen (one carbon atom with one oxygen atom). This forms carbon monoxide, CO. Carbon monoxide is the product of incomplete combustion and is a dangerous, potentially lethal gas.

Oxides of Nitrogen - NOx

NOx is a slightly different byproduct of combustion. Nitrogen is one of the elements that makes up the air going into the engine. Under extremely high temperatures it combines with oxygen to form oxides of nitrogen (NOx). This happens in the engine's combustion chambers when temperatures are too high. NOx itself is not harmful, but when exposed to sunlight it combines with unburned hydrocarbons to create the visible air pollutant known as smog. Smog is a serious problem in California as well as many other heavily populated areas of the United States.

Controlling Emissions

There are two principle methods of reducing emissions from a two-stroke-cycle marine engine. The first method is to control the air/fuel ratio that goes into the combustion chamber. The second is to control the time when this air/fuel mixture enters the combustion chamber. Timing is important, to prevent any unburned mixture from escaping out of the exhaust port.

Stoichiometric (14.7:1) Air/Fuel Ratio

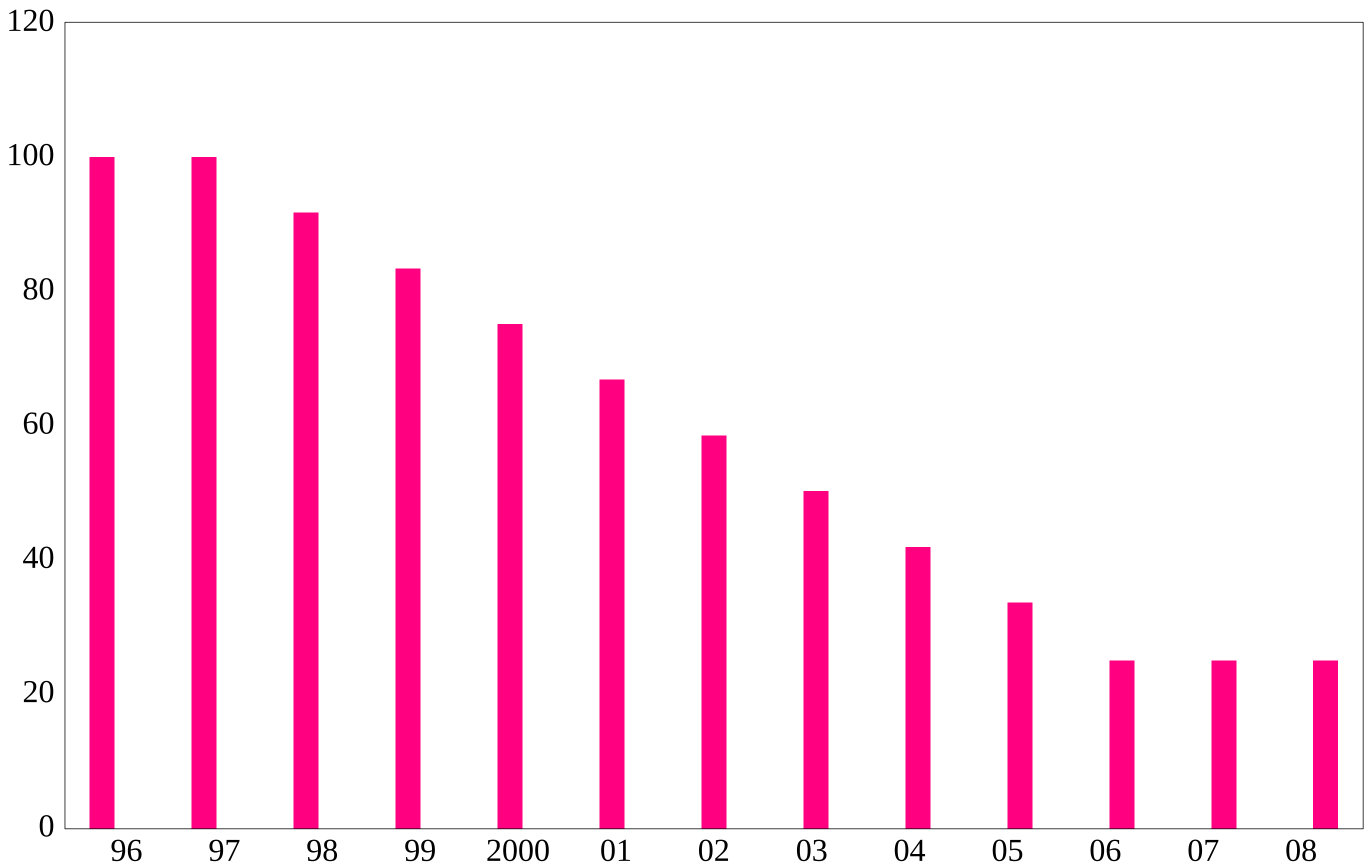
In the search to control pollutants and reduce exhaust emissions, engineers have discovered that they can be reduced effectively if a gasoline engine operates at an air/fuel ratio of 14.7:1. The technical term for this ideal ratio is stoichiometric. An air/fuel ratio of 14.7:1 provides the best control of all three elements in the exhaust under almost all conditions.

The HC and CO content of the exhaust gas is influenced significantly by the air/fuel ratio. At an air/fuel ratio leaner than 14.7:1, HC and CO levels are low, but with a ratio richer than 14.7:1 they rise rapidly. It would seem that controlling HC and CO by themselves might not be such a difficult task; the air/fuel ratio only needs to be kept leaner than 14.7:1. However, there is also NOx to consider.

As the air/fuel ratio becomes leaner, combustion temperatures increase. Higher combustion temperatures raise the NOx content of the exhaust. But, enrichening the air/fuel ratio to decrease combustion temperatures and reduce NOx also increases HC and CO, as well as lowering fuel economy. So the solution to controlling NOx - as well as HC and CO - is to keep the air/fuel ratio as close to 14.7:1 as possible.

OUTBOARD HYDROCARBON EMISSIONS REDUCTIONS

8 1/3% ↓ PER YEAR OVER 9 MODEL YEARS



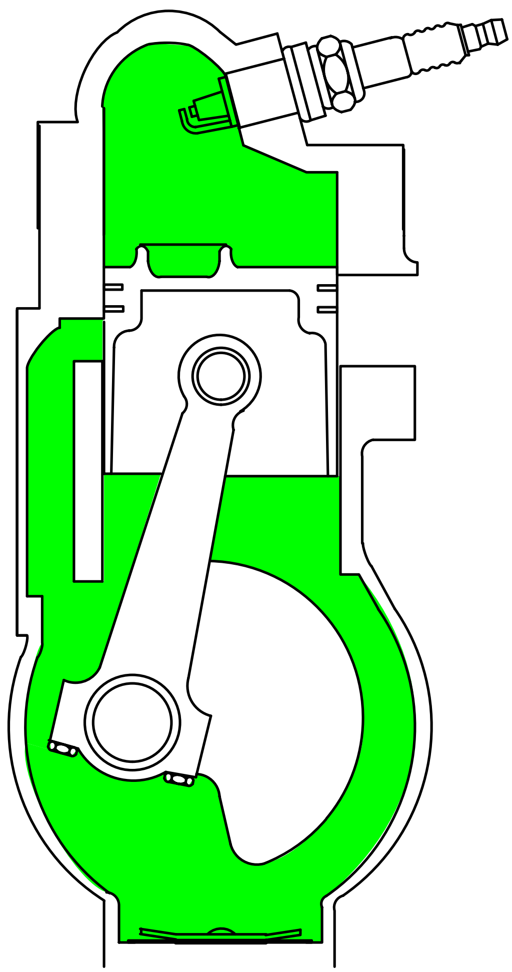
STRATIFIED VS HOMOGENIZED CHARGE

DFI engines use a stratified charge inside the combustion chamber to aid in reducing emissions. All other models use a homogenized charge. The difference between the two is:

Homogenized Charge

A homogenized charge has the fuel/air particles mixed evenly throughout the cylinder. This mixing occurs inside the carburetor venturi, reed blocks and crankcase. Additional mixing occurs as the fuel is forced through the transfer system into the cylinder.

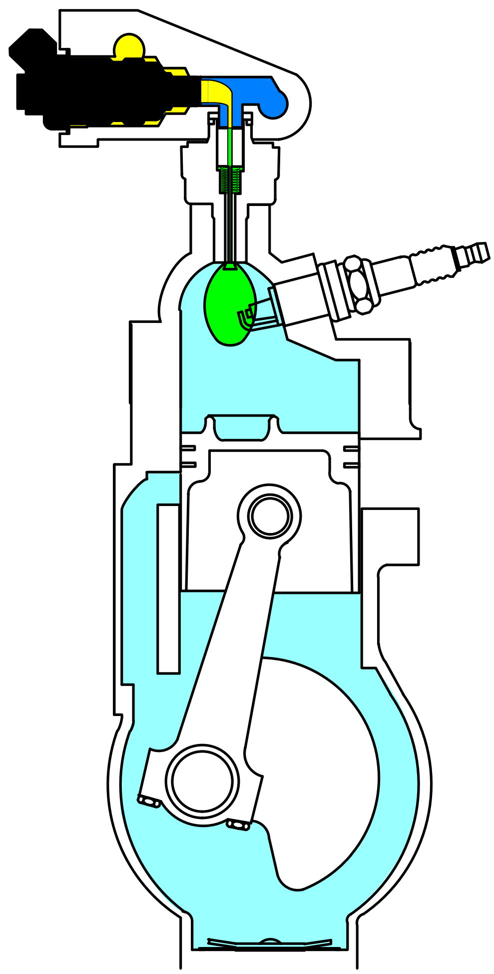
The homogenized charge is easy to ignite as the air/fuel ratio is approximately 14.7:1.



Stratified Charge

A stratified charge engine only pulls air through the transfer system. The fuel required for combustion is forced into the cylinder through an injector placed in the top of the cylinder (head). The injector sprays a fuel/air mixture in the form of a bubble into the cylinder. Surrounding this bubble is air supplied by the transfer system. As the bubble is ignited and burns, the surrounding air provides almost complete combustion before the exhaust port opens.

A stratified charge is hard to ignite, the fuel/air bubble is not evenly mixed at 14.7:1 and not easily ignited.



Emissions Information

Manufacturer's Responsibility:

Beginning with 1998 model year engines, manufacturers of all marine propulsion engines must determine the exhaust emission levels for each engine horsepower family and certify these engines with the United States Environmental Protection Agency (EPA). A certification decal/emissions control information label, showing emission levels and engine specifications directly related to emissions, **must** be placed on each engine at the time of manufacture.

Dealer Responsibility:

When performing service on all 1998 and later outboards that carry a certification, attention must be given to any adjustments that are made that affect emission levels.

Adjustments must be kept within published factory specifications.

Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the prescribed certification standards.

Dealers are **not** to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturers prescribed changes, such as that for altitude adjustments.

Owner Responsibility:

The owner/operator is required to have engine maintenance performed to maintain emission levels within prescribed certification standards.

The owner/operator is **not** to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

Single engine exceptions may be allowed with permission from the EPA for racing and testing.

EPA Emission Regulations:

All new 1998 and later outboards manufactured by Mercury Marine are certified to the United States Environmental Protection Agency as conforming to the requirements of the regulations for the control of air pollution from new outboard motors. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA laws on exhaust emissions for marine products. For more detailed information on this subject, you may contact the following locations:

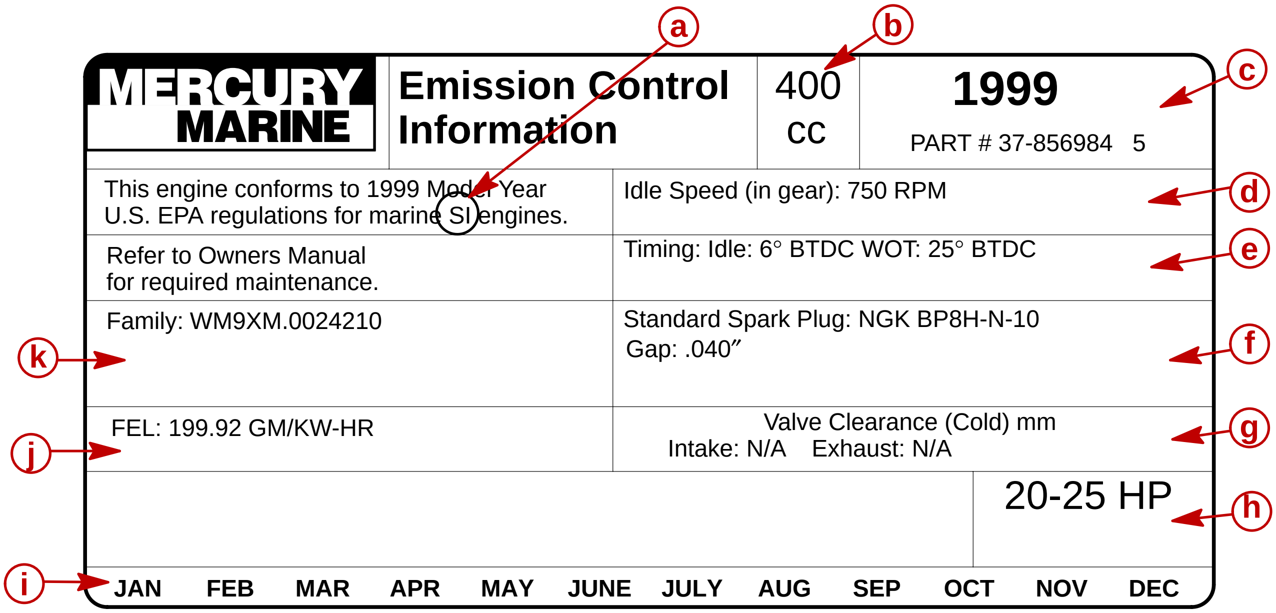
VIA U.S. POSTAL SERVICE:
Office of Mobile Sources
Engine Programs and Compliance Division
Engine Compliance Programs Group (6403J)
401 M St. NW
Washington, DC 20460

VIA EXPRESS or COURIER MAIL:
Office of Mobile Sources
Engine Programs and Compliance Division
Engine Compliance Programs Group (6403J)
501 3rd St. NW
Washington, DC 20001

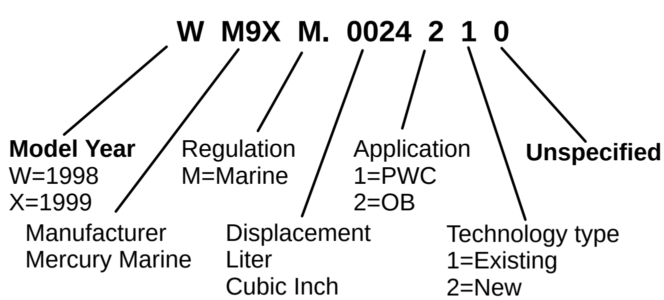
EPA INTERNET WEB SITE:
http:/www.epa.gov/omswww

CERTIFICATION LABEL:

The certification label must be placed on each engine at the time of manufacture and must be replaced in the same location if damaged or removed. Shown below is a typical certification label and is not representative of any one model. Label shown below is not to scale; (shown at twice the normal size).



a - Spark Ignition (SI)
b - Cubic Centimeter
c - Model year of engine and production decal part number
d - Idle Speed (In Gear)
e - Timing specifications when adjustable
f - Recommended spark plug for best engine performance
g - Valve Clearance (Four Stroke engines only)
h - Engine Horsepower rating
i - Month of production (Boxing month will punched)
j - FEL: Represents (Mercury Marine) statement of the maximum emissions output for the engine family
k - Family example



Decal Location:

Model	Production Part No.	Service Part No.	Location on Engine
1998 Merc/Mar 12,24 ci (20-25 H.P.)	37-855211 5	37-855577 5	Inside Top Cowl
1999 Merc/Mar 12,24 ci (20-25 H.P.)	37-856984 5	37-856985 5	Inside Top Cowl

POWERHEAD

Section 4 - Powerhead

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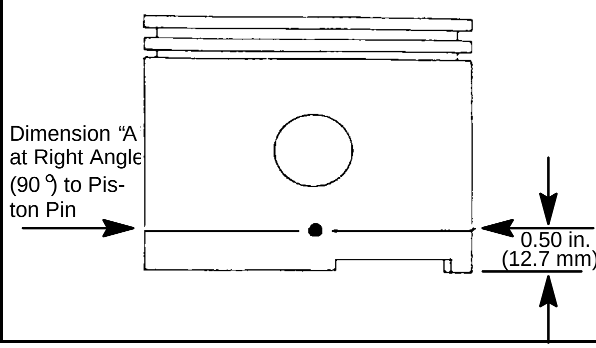
4

Specifications

HORSEPOWER (KW)	**Model 20 Jet** **Model 20** **Model 25**	20 (14.9) 20 (14.9 25 (18.7)
CYLINDER BLOCK	**Type** **Displacement**	Two Cylinder - Two Cycle 24.4 cu. in. (400 cc)
STROKE	**Length**	2.362 in. (60 mm)
CYLINDER BORE	**Diameter (Standard)** **Taper/Out of Round Maximum*** **Bore Type:** **S/N 0G202749 and Below** **S/N 0G202750 and Above**	2.562 in. (65.01 mm) 0.003 in. (0.08 mm)* Chrome Mercosil
CRANK SHAFT	**Top Main Bearing Journal** **Center Main Bearing Journal** **Bottom Main Bearing Journal** **Connecting Rod Journal** **End Play**	1.251 in. (31.77 mm) 1.000 in. (25.40 mm) 1.125 in. (28.58 mm) 0.883 in. (22.43 mm) 0.004-0.019 (0.10-0.64 mm)
CONNECTING ROD	**Piston Pin End (I.D.)** **Crankpin End (I.D.)**	0.897 in. (22.78 mm) 1.196 in. (30.38 mm)
PISTON	**Piston Type** **O.D. at Skirt (Standard)** **Ring End Gap**	Aluminum 2.5583 - 2.5593 (64.98 - 65.00) 0.011-0.025 (.28 mm - .64 mm)
PISTON DIA.		2.5583 in. ± .0005 in. (64.98 mm ± .0127 mm)**Using a micrometer, measure dimension "A" at location shown. Dimension "A" should be 2.5583 in. ± .0005 for a STANDARD size piston (new) Dimension "A" will be 0.001 – 0.0015 less if coating is worn off piston (used)**

***Models S/N 0G202749 and Below:**

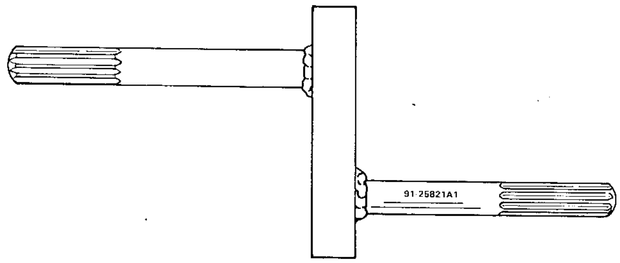
NOTE: *The cylinder bores are chrome and cannot be be rebored or efficiently honed. Check each cylinder bore for an out-of-round "egg shaped" cylinder. A maximum of 0.003 in. (0076mm) is allowable.*

***Models S/N 0G202750 and Above:**

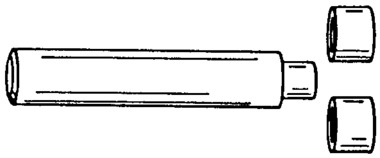
NOTE: *The cylinder block is Mercosil and the cylinders can be rebored to 0.030 in. oversized. Check each cylinder bore for an out-of-round "egg shaped" cylinder. A maximum of 0.003 in. (0.076mm) is allowed.*

Special Tools

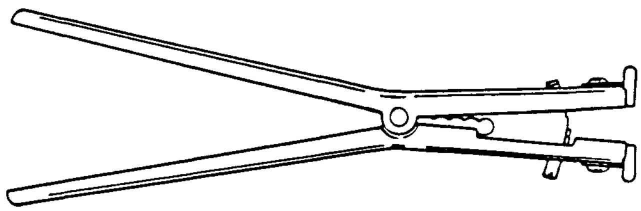
1. Powerhead Stand 91-25821A1



2. Piston Pin Tool 91-76160A2

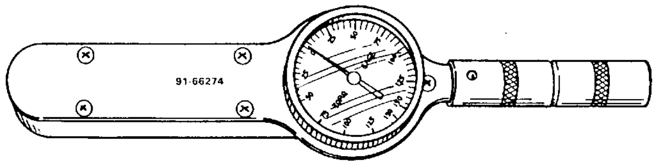


3. Piston Ring Expander 91-24697

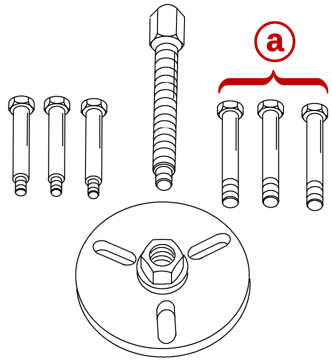


4. Torque Wrench (0 – 200lb. ft.) 91-32610*

5. Torque Wrench (0 – 150lb. in.) 91-66274*

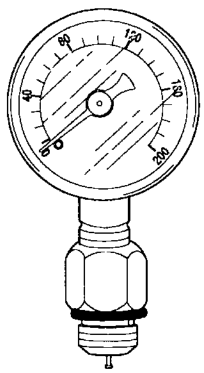


6. Flywheel Puller 91-83164M

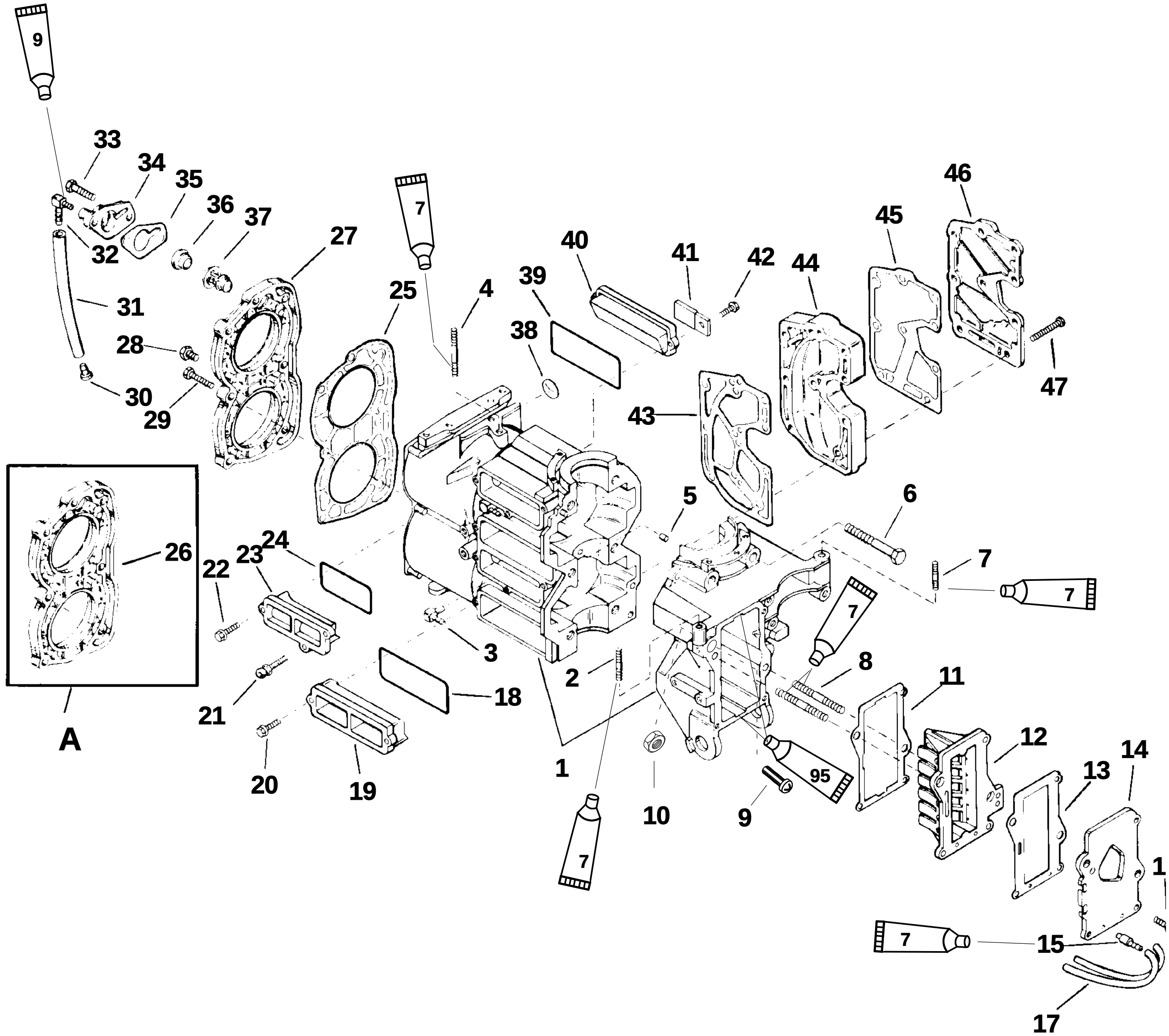


a - Bolts 10mm (3) 91-83191M

7. Compression Tester 91-29287



Cylinder Block and Covers



7 Loctite 271 (92-809820)

9 Loctite PST Pipe Sealant (92-809822)

12 Loctite Master Gasket (92-12564-2)

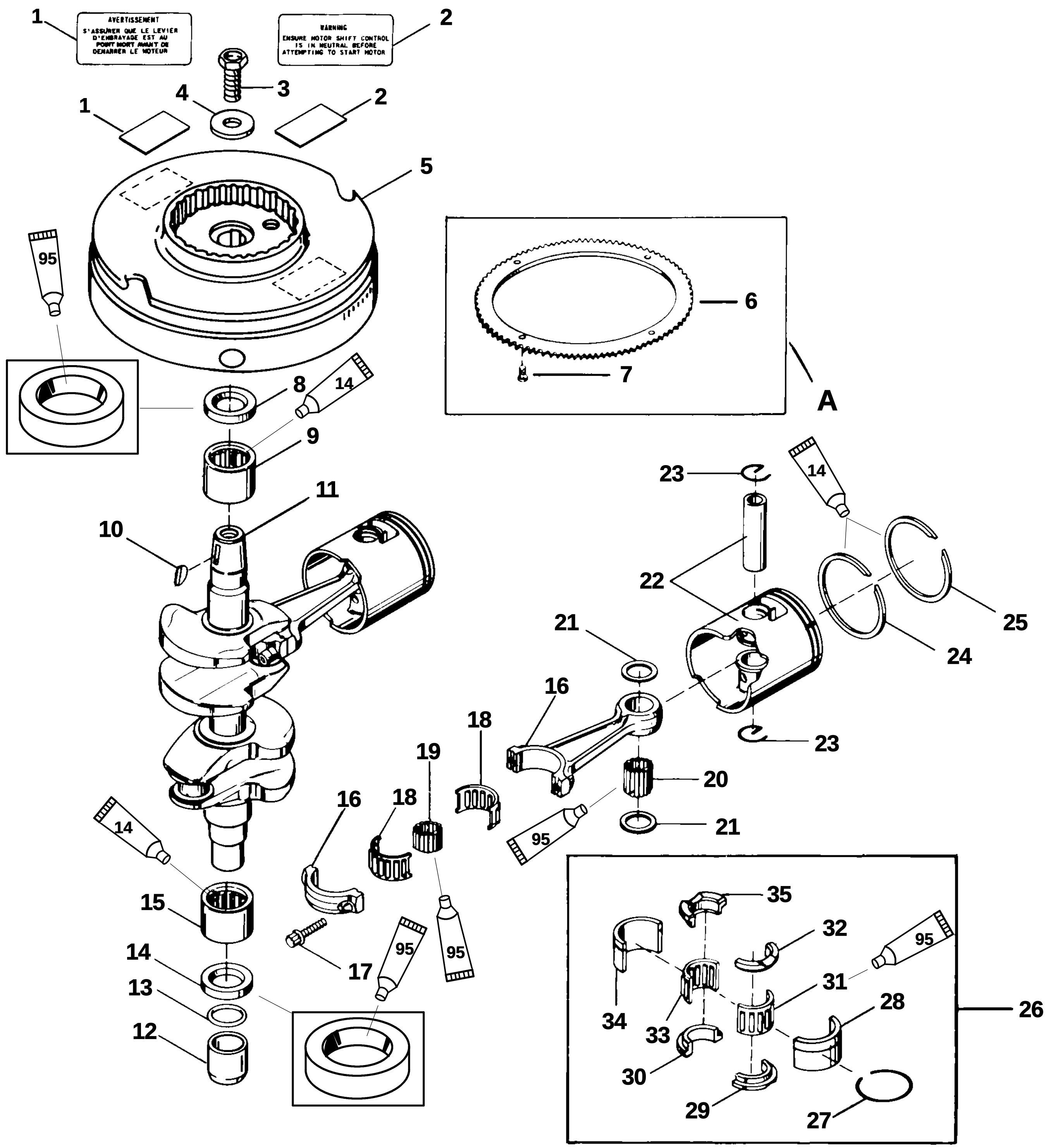
95 2-4-C With Teflon (92-825407A12)

SIDE SHIFT AND TILLER SHIFT ONLY

Cylinder Block and Covers

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	CYLINDER BLOCK			
2	1	STUD (M6x1x32)	Drive Tight		
3	2	ELBOW (45 deg.)			
4	1	STUD (M6x1x50) (Commercial)	Drive Tight		
5	1	DOWEL PIN			
6	5	SCREW (60 MM)	360	30	40.7
7	1	STUD (M6x1x32)	Drive Tight		
8	2	STUD	Drive Tight		
9	1	SCREW			
10	1	NUT			
11	1	GASKET			
12	1	REED BLOCK			
13	1	GASKET			
14	1	PLATE-carb adaptor			
15	2	CHECK VALVE			
16	3	SCREW (M5x.8x20)	80		9.0
17	2	TUBING (13-1/4 IN.)			
18	2	O-RING			
19	2	COVER			
20	4	SCREW (M5x.8x16)	40		4.5
21	1	BALL-threaded	40		4.5
22	6	SCREW (M5x.8x16)	40		4.5
23	2	COVER			
24	2	O-RING			
25	1	GASKET			
26	1	COVER CASTING			
27	1	COVER ASSEMBLY			
28	1	PIPE PLUG (BRASS)	Drive Tight		
29	5	SCREW (30 MM)	140	12.0	15.8
30	1	FITTING			
31	1	HOSE-tell tale (8 IN.)			
32	1	ELBOW	Drive Tight		
33	2	SCREW (M6x1x40)	140	12.0	15.8
34	1	COVER			
35	1	GASKET			
36	1	GASKET			
37	1	THERMOSTAT			
38	1	PLUG-serial number	Stake Tight		
39	2	O-RING			
40	2	COVER			
41	1	STRAP			
42	4	SCREW (M5x.8x16)	40		4.5
43	1	GASKET-exhaust manifold			
44	1	EXHAUST MANIFOLD			
45	1	GASKET-exhaust manifold cover			
46	1	COVER-exhaust manifold			
47	9	SCREW (M6 x 1 x 40)	140	12.0	15.8

Crankshaft, Pistons and Flywheel



7 Loctite 271 (92-809820)

14 2 Cycle Outboard Oil (92-13249A24)

95 2-4-C With Teflon (92-825407A12)

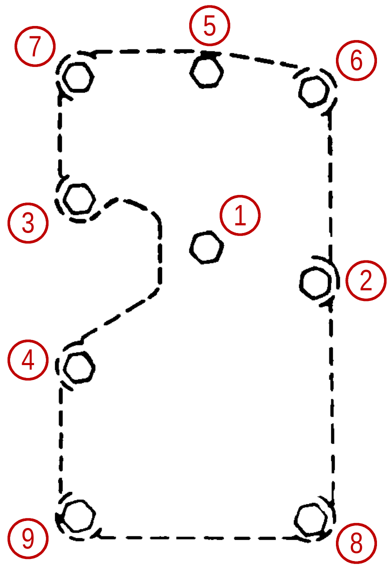
A=ELECTRIC START MODELS ONLY

Crankshaft, Pistons and Flywheel

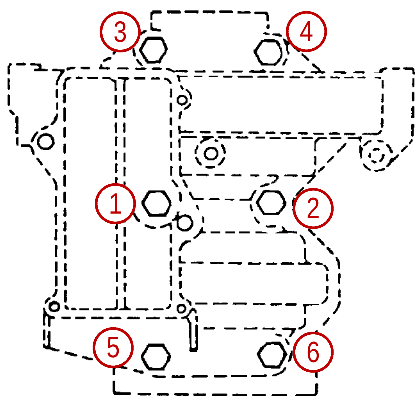
REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	DECAL–warning (NOT A SERVICE PART)			
2	1	DECAL–warning (NOT A SERVICE PART)			
3	1	SCREW–flywheel to crankshaft		57.5	78.0
4	1	WASHER–flywheel screw			
5	1	FLYWHEEL			
6	1	RING GEAR–flywheel **ELECTRIC**			
7	4	SCREW (M5x.8x13)	65		7.4
8	1	OIL SEAL–crankshaft-upper (Qty. of 2 used on Electric RC)			
9	1	ROLLER BEARING–upper			
10	1	KEY–flywheel drive			
11	1	CRANKSHAFT ASSEMBLY			
12	1	WEAR SLEEVE KIT			
13	1	O-RING (Part of Ref. #12)			
14	1	OIL SEAL–crankshaft - lower			
15	1	ROLLER BEARING–lower			
16	2	CONNECTING ROD ASSEMBLY			
17	4	SCREW	175	15.0	19.8
18	2	ROLLER BEARING ASSEMBLY			
19	24	ROLLER (Part of Ref. #18)			
20	54	NEEDLE BEARING–piston end			
21	4	BEARING–thrust			
22	2	PISTON AND PIN ASSEMBLY			
23	4	LOCK RING–piston pin **USA-S/N 0G202749 & BELOW**			
24	1	PISTON RING **BEL-09855586 & BELOW**			
25	2	PISTON RING (Part of Ref. #24)			
22	2	PISTON AND PIN ASSEMBLY **(STD.)**			
	2	PISTON AND PIN ASSEMBLY **(.030 O/S)**			
23	4	LOCK RING–piston pin **USA-S/N 0G202750 & UP**			
24	1	PISTON RING ASSEMBLY **(STD.** **BEL-09855587 & UP**			
	1	PISTON RING ASSEMBLY **(.030 O/S)**			
25	2	PISTON RING (Part of Ref. #24)			
26	1	BEARING ASSEMBLY–center main			
27	1	BEARING			
28	1	BEARING			
29	1	THRUST WASHER			
30	1	THRUST WASHER			
31	1	NEEDLE ROLLER			
32	1	THRUST WASHER			
33	1	NEEDLE ROLLER			
34	1	BEARING			
35	1	THRUST WASHER			

Torque Sequence

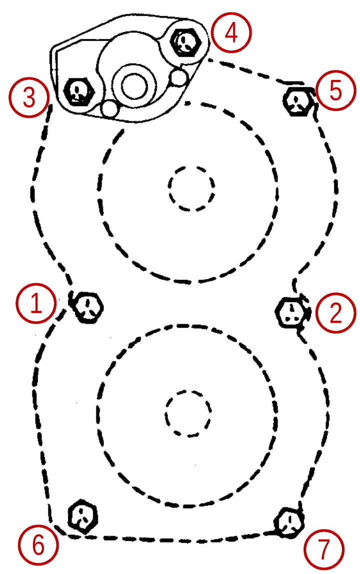
1. Exhaust Cover [140 lb. in. (15.8 N·m)]



2. Crankcase Cover [30.0 lb. ft. (41.1 N·m)]



3. Cylinder Block Cover [140 lb. in. (15.8 N·m)]

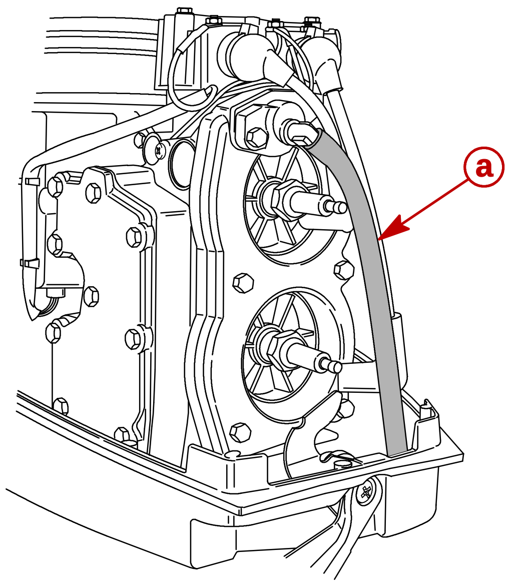


Powerhead Removal

1. Remove the following components/assemblies referring to the listed service manual sections:

Component/Assembly	Section
Rewind Starter	8
Flywheel and Ignition/Electrical Components	2A/B
Throttle/Shift Mechanism	7A/B/C
Carburetor	3A

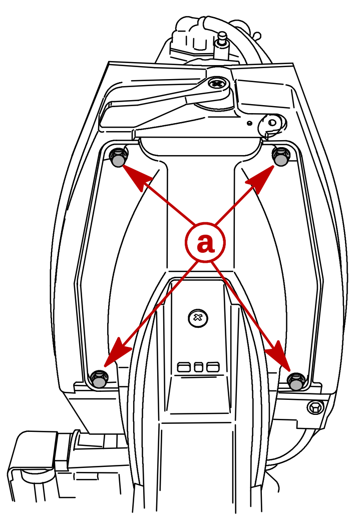
2. Disconnect tell-tale hose from bottom cowl.



57073

a - Tell-tale Hose

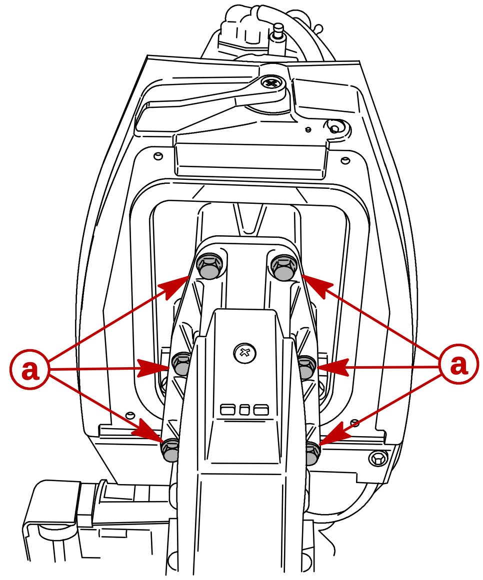
3. Remove 4 bolts.



57076

a - Bolts (2 each side)

4. Remove 6 bolts securing powerhead.

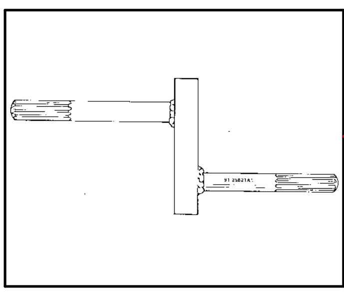


57077

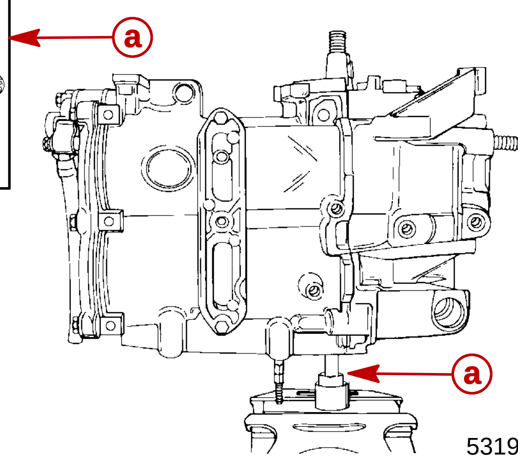
a - Bolts (3 each side)

5. Rock powerhead to break gasket and lift powerhead from drive shaft housing.

6. Place powerhead on bench or powerhead stand (91-25821A1) mounted in vise.



53203



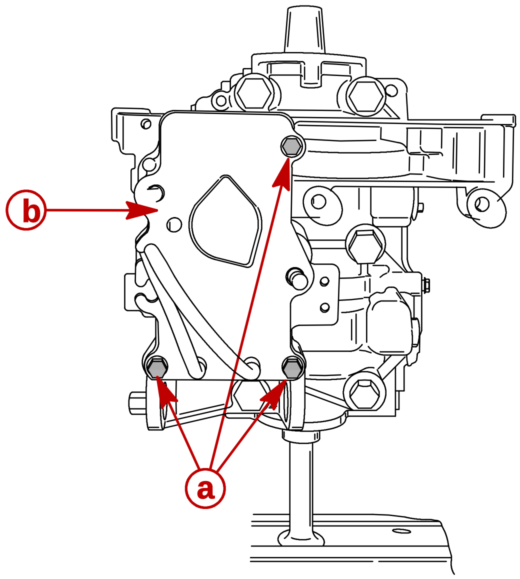
53197

a - Powerhead Stand (91-25821A1)

Powerhead Disassembly

Cylinder Block

1. Remove 3 bolts and remove intake manifold/reed block.

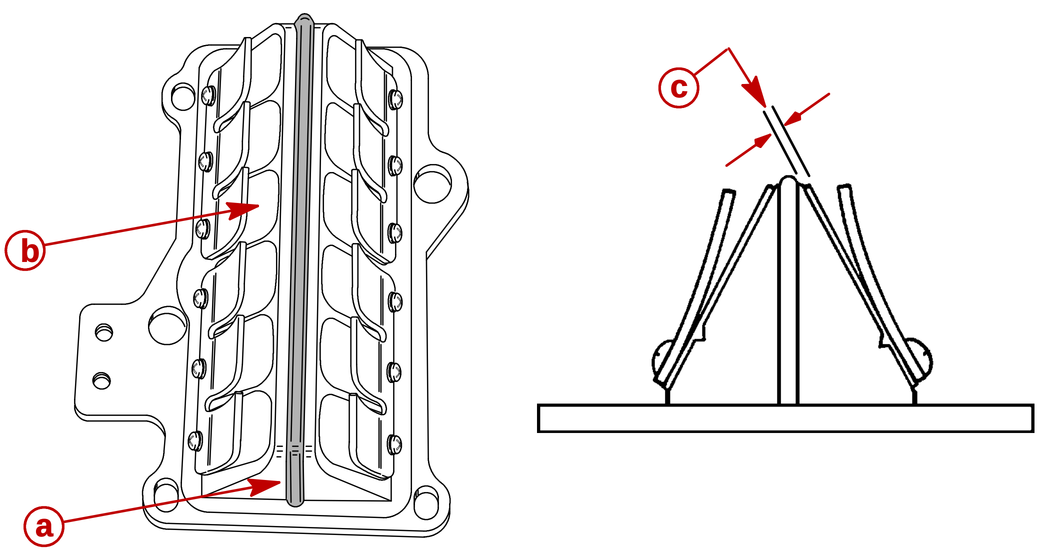


57079

a - Bolts
b - Intake Manifold/Reed Block

IMPORTANT: Reed block can be inspected without disassembling. If inspection of reed block indicates that replacement of a part is necessary, entire reed block assembly must be replaced as individual parts are not sold separately.

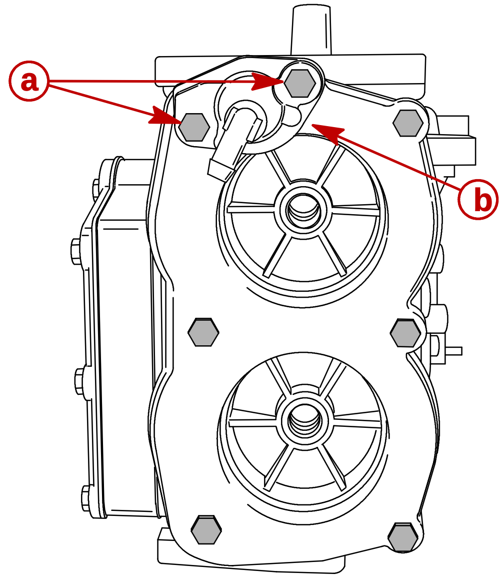
2. Inspect seal for cuts or abraisions. If seal is damaged, entire reed block assembly must be replaced.
3. Inspect reeds for cracks or chips.



57080

a - Seal
b - Reeds
c - Reed Valve Opening – Maximum Opening 0.007 in. (0.178mm)

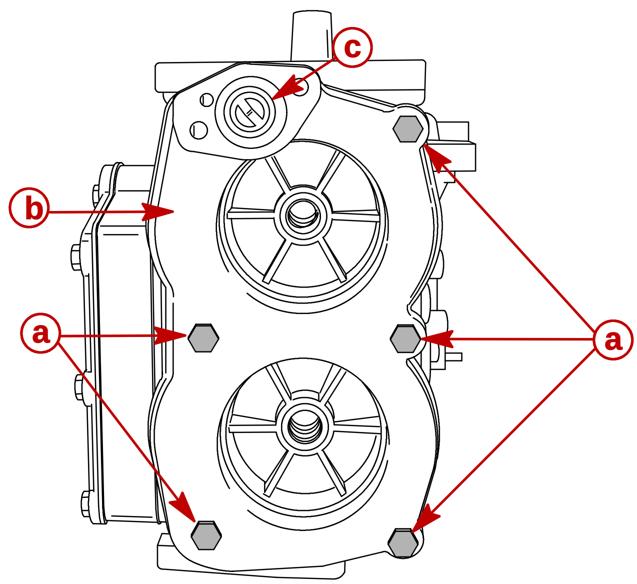
4. Remove 2 bolts and remove thermostat cover.



57081

a - Bolts (2)
b - Cover

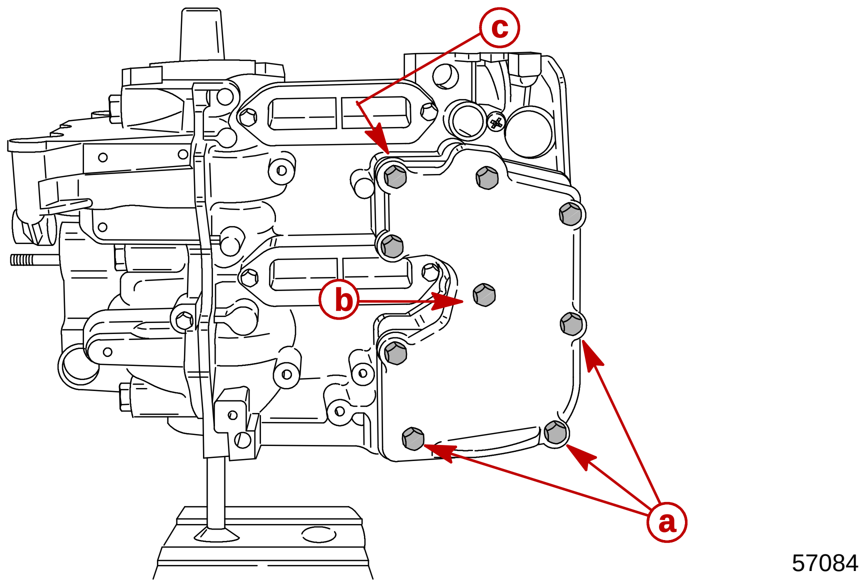
5. Remove thermostat (if equipped).
6. Remove 5 bolts and remove cylinder block cover.



57082

a - Bolts
b - Cover
c - Thermostat (if equipped)

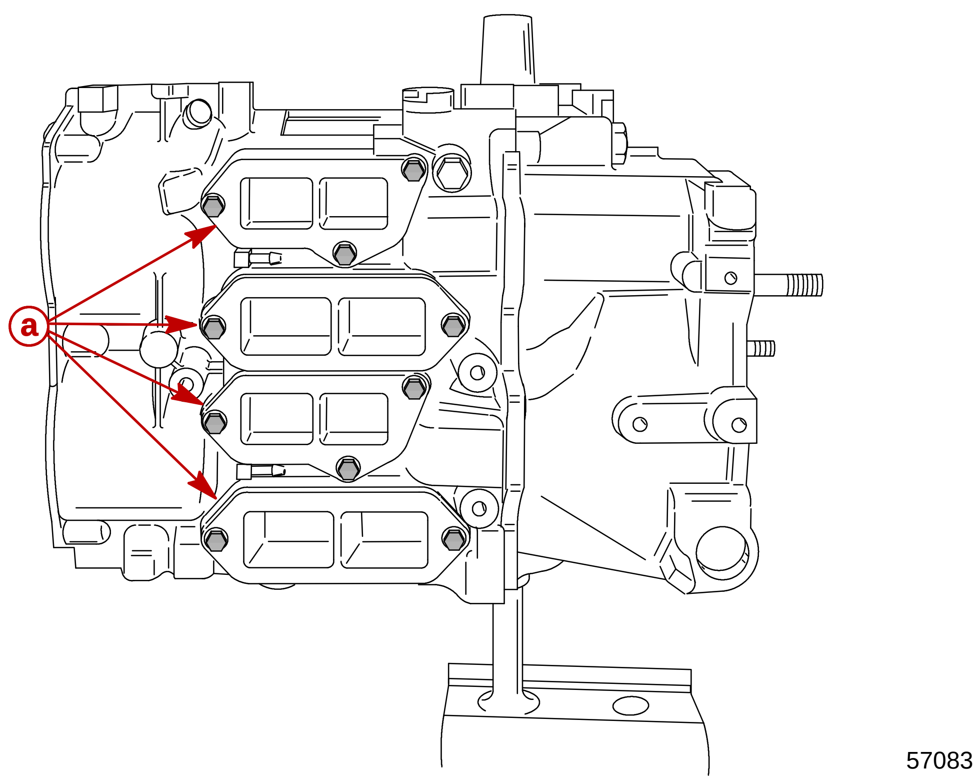
7. Remove 9 bolts and separate exhaust cover and exhaust manifold from cylinder block.



a - Bolts (9)
b - Exhaust Cover
c - Exhaust Manifold

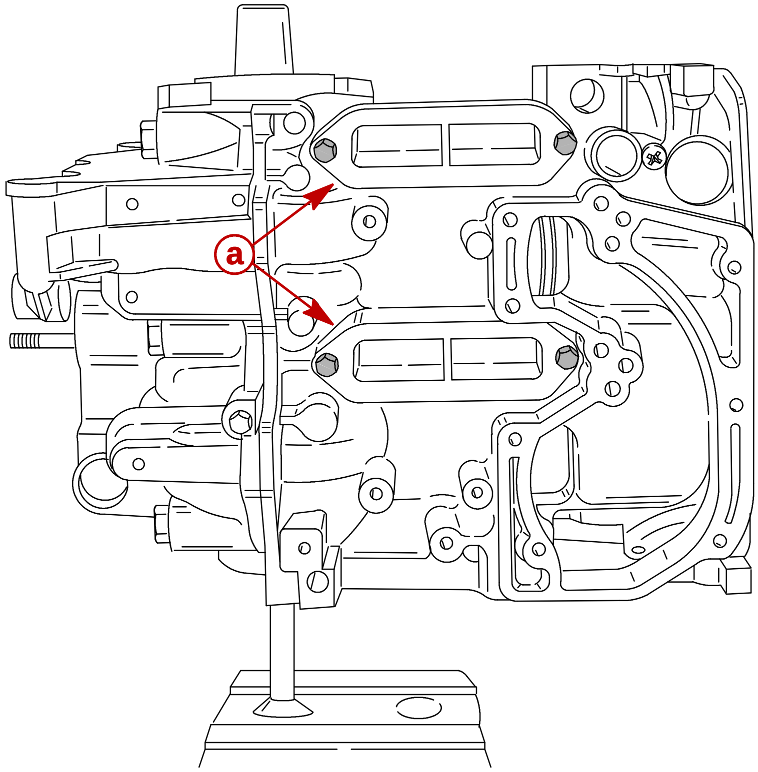
NOTE: *If engine is suspected of having been overheated or spark plugs are grayish colored (a sign of possible water intrusion), inspect exhaust manifold for warpage or for proper placement and integrity of gaskets which will allow water to enter cylinders through exhaust ports.*

8. Remove 10 bolts and 4 transfer covers – **Starboard Side**



a - Transfer Covers

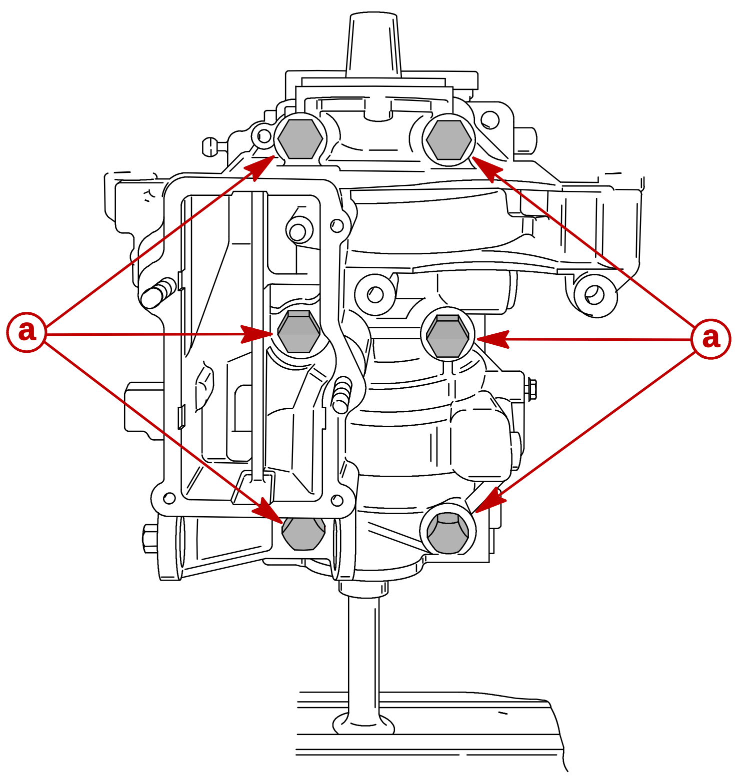
9. Remove 4 bolts and 2 transfer covers – **Port Side**.



57085

a - Transfer Covers

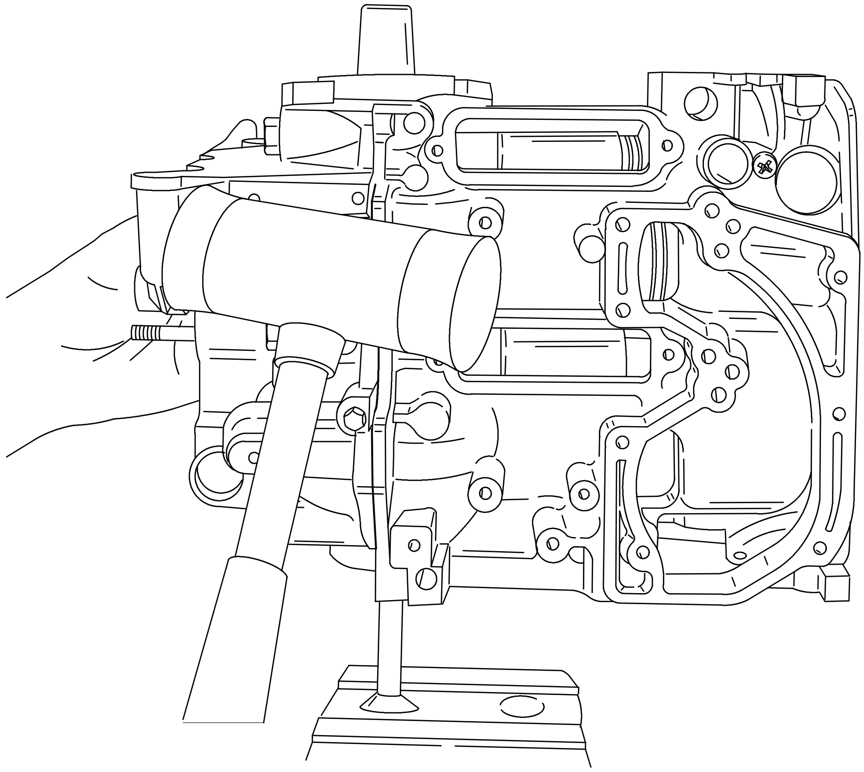
10. Remove 6 bolts which secure crankcase cover to cylinder block.



57090

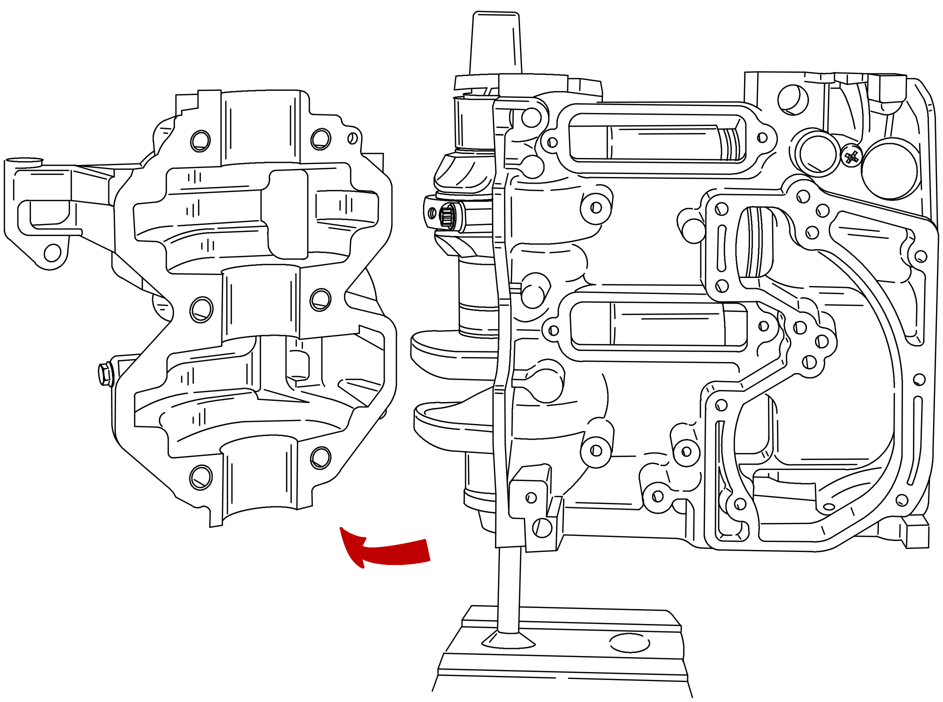
a - Bolts (6)

11. Use soft mallet to break seal between crankcase cover and cylinder block.



57086

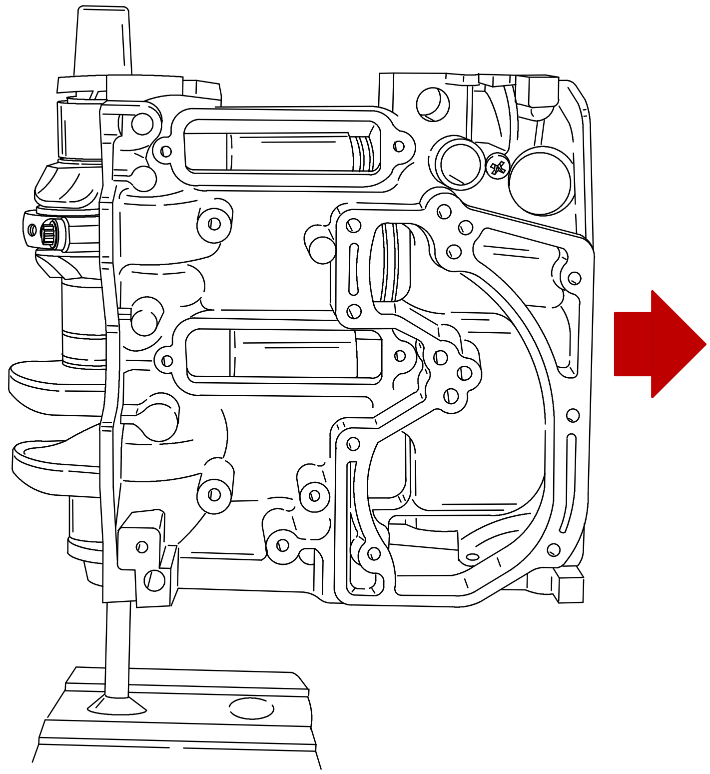
12. Lift crankcase cover from block.



57087

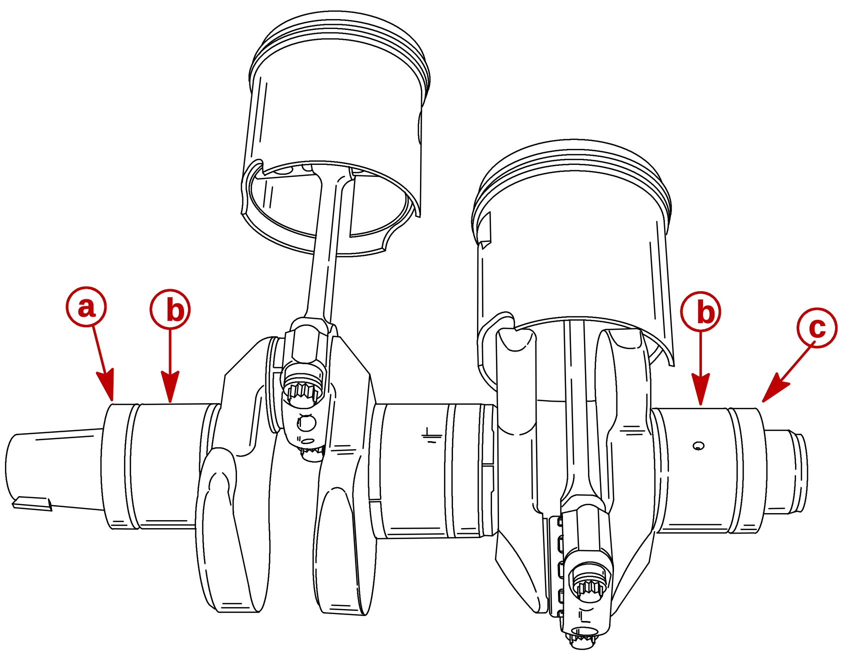
Crankshaft

1. Remove cylinder block from crankshaft assembly.



57088

2. Slide upper and lower roller bearings and seals off of crankshaft. Discard seals.

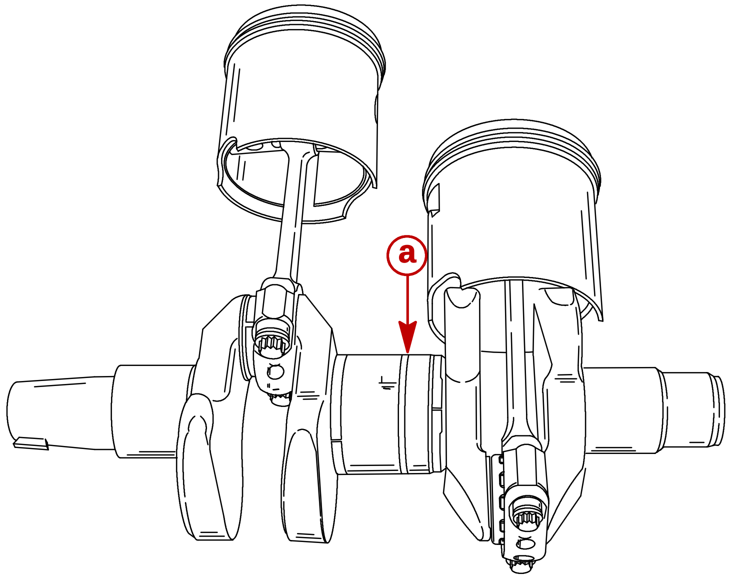


57089

a - Crankshaft Seal (Upper)
b - Bearing
c - Crankshaft Seal (Lower)

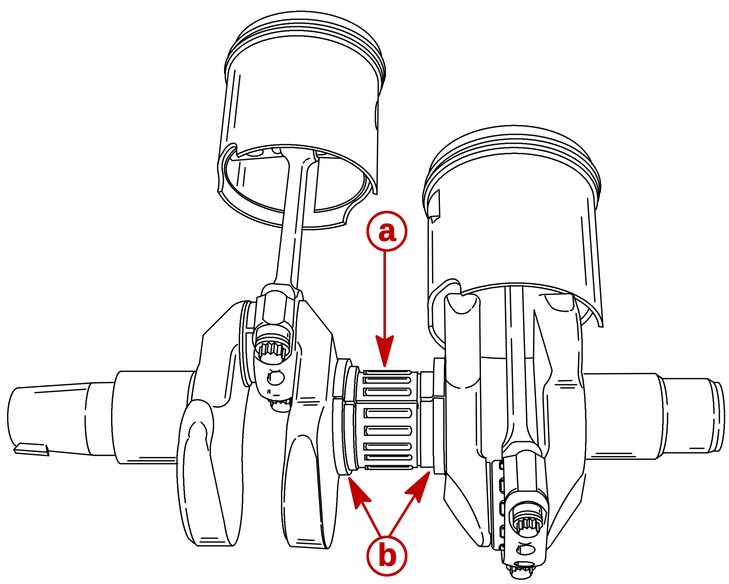
CENTER MAIN BEARING REMOVAL

1. Remove retaining ring from groove of center main bearing race.



a - Retaining Ring

2. Remove center main bearing races and center main bearing halves. Remove main bearing thrust washers.



a - Bearing Halves
b - Thrust Washers

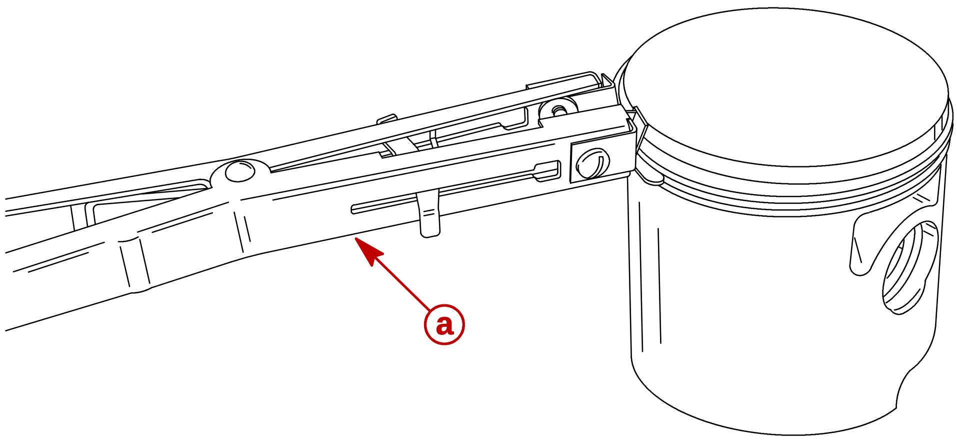
PISTON AND ROD DISASSEMBLY

⚠ CAUTION

Eye protection MUST BE worn while removing piston pin lockrings.

IMPORTANT: Identify upper (#1) and lower (#2) pistons and connecting rods. Store piston pin, piston pin needle bearings, locating washers, connecting rod bearings, rod caps and bolts together with corresponding piston and connecting rod for reassembly.

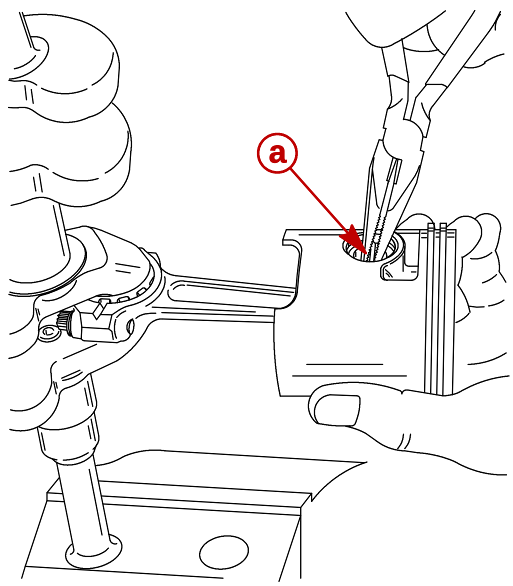
1. Using Piston Ring Expander (91-24697), remove (and discard) piston rings.



57094

a - Ring Expander (91-24697)

2. Remove (and discard) piston pin lockrings.



57098

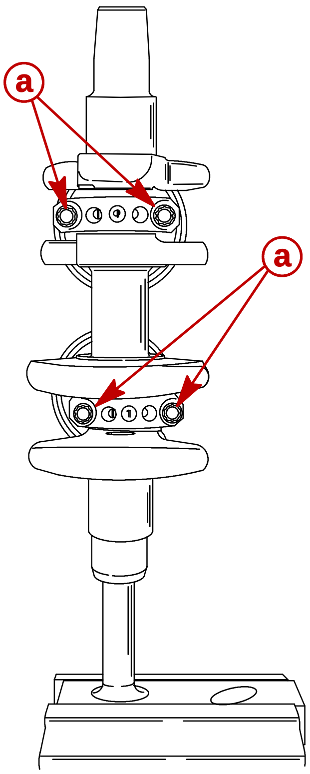
a - Lockrings (discard)

IMPORTANT: It is recommended that the piston and rod assembly be removed from the crankshaft before removing the piston pin to prevent possible bending of the connecting rod.

IMPORTANT: It is recommended that new needle bearings be installed in connecting rod to assure lasting repair. If needle bearings must be reused, they should be reassembled on the same crankpin throw and on the same connecting rod.

IMPORTANT: Keep the same connecting rod, cap, cage and roller bearings (if reused) together and install them in their original location on the crankshaft.

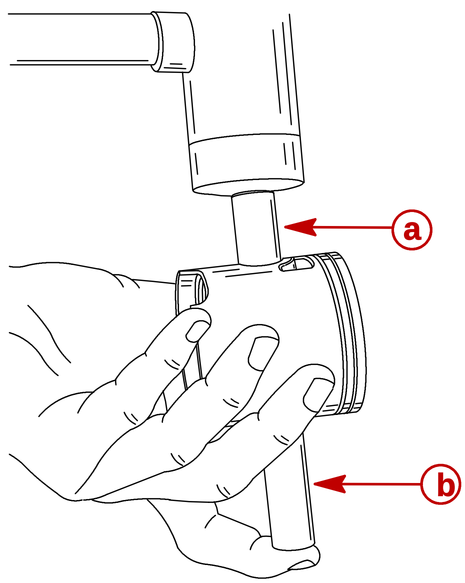
3. Remove (and discard) rod bolts and remove piston and rod assembly from crankshaft.



57099

a - Rod Bolts (discard)

4. While supporting piston, use Piston Pin Tool 91-76160A2 and soft faced mallet to drive piston pin from piston.

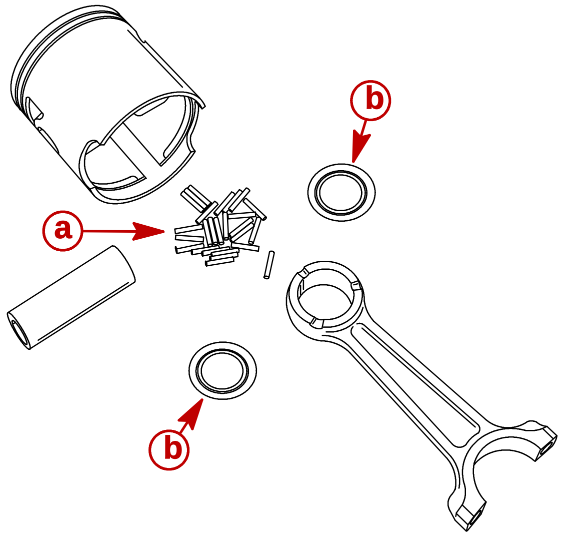


57100

a - Piston Pin Tool (91-76160A2)
b - Piston Pin

IMPORTANT: Piston pin needle bearings and locating washers will fall out when piston is removed from connecting rod.

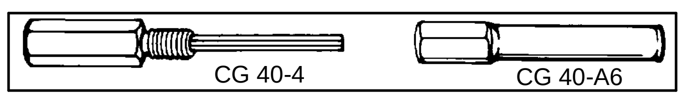
5. Slide piston pin tool from piston and remove piston, needle bearings and locating washers.



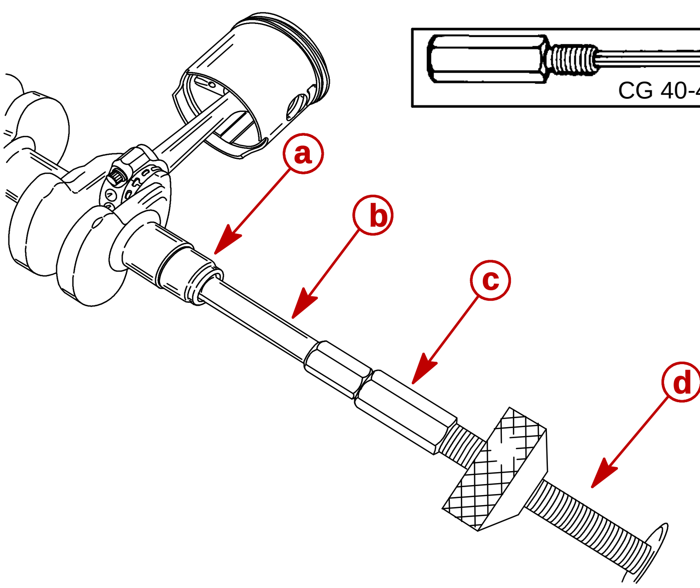
57101

a - Needle Bearings
b - Locating Washers

6. Remove (and discard) coupling seal using:
   Snap On* Expanding Rod (CG 40-4)
   Snap On Collet (CG 40-A6)
   Slide Hammer (91-34569A1)
   *Purchase from: Snap On Tools Corporation
   2801 - 80th Street
   Kenosha, WI 53141-1410



53045



57102

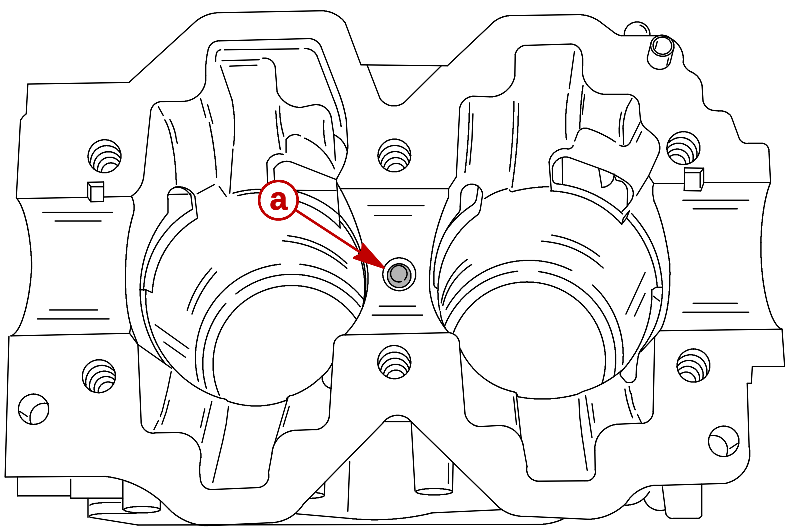
a - Coupling Seal
b - Collet (CG 40-15)
c - Expanding Rod (CG 40-4)
d - Slide Hammer (91-34569A1)

Powerhead Cleaning and Inspection

Cylinder Block and Crankcase Cover

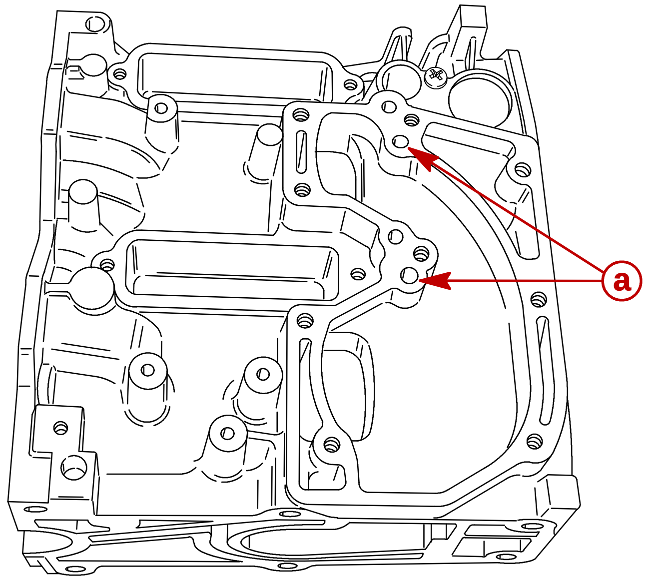
IMPORTANT: Crankcase cover and cylinder block are a matched, line-bored assembly and must be replaced as a set.

1. Thoroughly clean cylinder block and crankcase cover with Quicksilver Power Tune Engine Cleaner (91-92-15104A12). Verify that all sealant and old gaskets are removed from mating surfaces. Remove all carbon deposits from exhaust ports, decompression ports and cylinder dome.
2. Inspect cylinder block and crankcase cover for cracks or fractures.
3. Check gasket surfaces for nicks, deep grooves, cracks and distortion.
4. Inspect all water and fuel passages in cylinder block and crankcase cover for obstructions.
5. Verify that all fittings and plugs are tight. If the center main bearing alignment pin is loose, cylinder block and crankcase cover must be replaced.



57125

a - Alignment Pin



a - Decompression Ports

Exhaust Manifold and Exhaust Cover

1. Remove all carbon deposits and gasket material from exhaust manifold and cover.
2. Inspect for grooves, cracks or distortion that could cause leakage. Replace parts as required.

Cylinder Bore

CHROME BORE – ALL MODELS S/N OG202749 AND BELOW

Cylinder bores which are chrome cannot be bored or efficiently honed. Honing a chrome cylinder bore is not necessary nor is it recommended. Do not mistake cylinder bore porosity (pitting) for cylinder damage. Porosity in a chrome lined cylinder is normal and is not detrimental to engine operation or performance.

1. If chrome surface is flaking, or if a groove or any other mark penetrates the chrome surfacing to the aluminum portion of the cylinder wall, the cylinder block must be replaced.
2. To determine if a groove or mark on the cylinder wall penetrates the chrome surfacing to the aluminum cylinder wall, apply a small amount of diluted muriatic acid (TIDY BOWL CLEANER) to the groove or mark. If the groove or mark begins to "fizz", the aluminum wall is exposed and the cylinder block and crankcase cover must be replaced.
3. If a piston is scored and transferred aluminum to the cylinder walls, remove the aluminum from the wall as follows:
   a. Remove all loose aluminum deposits from cylinder walls with a stiff bristle brush.
   b. Apply a small amount of diluted muriatic acid (TIDY BOWL CLEANER) onto aluminum deposits. A "fizzing" action will appear indicating that aluminum is being dissolved.
   c. Leave the acid solution on the aluminum deposit for 1 to 2 minutes, then wash cylinder thoroughly with hot water and detergent.
   d. Steps "b" and "c" may require repeating several times before all aluminum deposits are gone.
   e. After cleaning aluminum deposits from cylinder bores, apply light oil to each cylinder bore with a clean cloth.

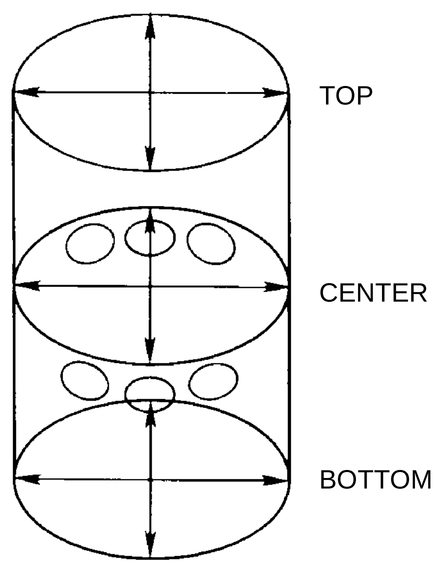
4. Check each cylinder bore for an out-of -round "egged shaped" cylinder. A maximum of 0.003 in. (0.076mm) is allowable. If out-of-round is more than 0.003 in. (0.076 mm), cylinder block and crankcase cover must be replaced.

MERCOSIL BORE – ALL MODELS S/N OG202750 AND ABOVE

1. Inspect cylinder bores for scoring, scuffing or a transfer of aluminum from piston to cylinder wall. Scoring or scuffing, if NOT TOO SEVERE, can normally be removed by honing. If a transfer of aluminum has occurred, a diluted muriatic acid such as "TIDY BOWL CLEANER" should be applied to the areas of the cylinder bore where transfer of aluminum has occurred. After the acidic solution has removed the transferred aluminum, thoroughly wash the cylinder bore(s) with hot water and detergent to remove any remaining acid. Cylinder walls may now be honed to remove any glaze and to aid in the seating of new piston rings.
2. The cylinder block is Mercosil and if necessary can be rebored to 0.030 in. (0.762 mm) oversized.
3. Check each cylinder bore for an out-of -round "egged shaped" cylinder. A maximum of 0.003 in. (0.076 mm) is allowable. If out-of-round is more than 0.003 in. (0.076 mm), cylinder block and crankcase cover must be replaced.

MEASURING CYLINDER BORE

1. Measure ring traveled area of cylinder bore at 3 depths, (6 places) by positioning measuring instrument in-line with and at right angle (90°) to piston pin centerline.
2. If cylinder bore is tapered, egg shaped or out-of-round by more than 0.003 in. (0.076 mm), replace cylinder block.



STANDARD CYLINDER BORE DIAMETER

20/25/20 JET	BORE TYPE	STANDARD BORE DIAMETER
ALL MODELS S/N OG202749 AND BELOW	The cylinder bores are chrome and cannot be rebored or efficiently honed. Check each cylinder bore for an out-of -round "egged shaped" cylinder. A maximum of 0.003 in. (0.076 mm) is allowable.	2.562 in. (65.01 mm)
ALL MODELS S/N OG202750 AND ABOVE	The cylinder block is Mercosil and the cylinders can be rebored to 0.030 in. (0.762 mm) oversized. Check each cylinder bore for an out-of-round "egged shaped" cylinder. A maximum of 0.003 in. (0.076 mm) is allowable.	2.562 in. (65.01 mm)

HONING PROCEDURE

a. When cylinders are to be honed, follow the hone manufacturer's recommendations for use of the hone and cleaning and lubrication during honing.

b. For best results, a continuous flow of honing oil should be pumped into the work area. If pumping oil is not practical, use an oil can. Apply oil generously and frequently on both stones and work area.

⚠ CAUTION

When honing cylinder block, remove hone frequently and check condition of cylinder walls. DO NOT hone any more than absolutely necessary, as hone can remove cylinder wall material rapidly.

c. Start stroking at smallest diameter. Maintain firm stone pressure against cylinder wall to assure fast stock removal and accurate results.

d. Localize stroking in the smallest diameter until drill speed is constant throughout length of bore. Expand stones, as necessary, to compensate for stock removal and stone wear. Stroke at a rate of 30 complete cycles per minute to produce best cross-hatch pattern. Use honing oil generously.

e. Thoroughly clean cylinder bores with hot water and detergent. Scrub well with a stiff bristle brush and rinse thoroughly with hot water. A good cleaning is essential. If any of the abrasive material is allowed to remain in the cylinder bore, it will cause rapid wear of new piston rings and cylinder bore in addition to bearings. After cleaning, bores should be swabbed several times with engine oil and a clean cloth, then wiped with a clean, dry cloth. Cylinders **should not** be cleaned with kerosene or gasoline. Clean remainder of cylinder block to remove excess material spread during honing operation.

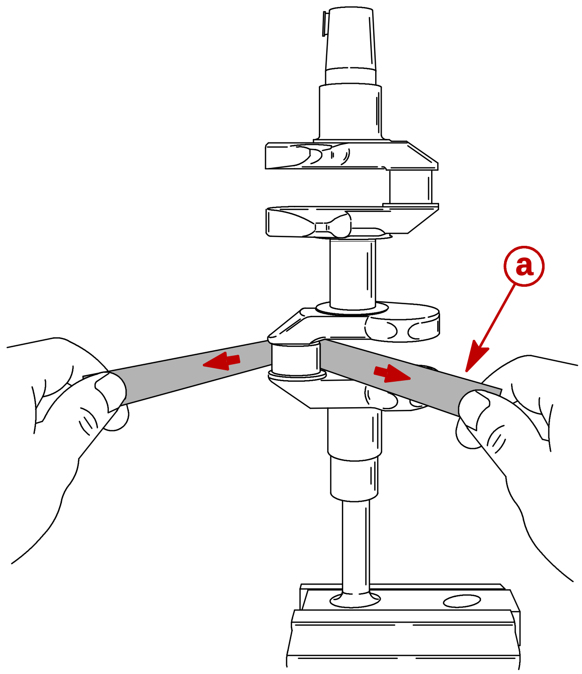
3. Hone all cylinder walls **just enough** to de-glaze walls.

4. Measure cylinder bore diameter (with a snap gauge micrometer) at top, middle and bottom of each cylinder. Check for tapered, out-of-round (egg-shaped) and oversize bore.

IMPORTANT: Ports must be deburred after honing.

Crankshaft

1. Inspect crankshaft to drive shaft splines for wear.
2. Check crankshaft for straightness – runout – 0.003 in. (0.076 mm).
3. Inspect crankshaft oil seal surfaces. Sealing surfaces must not be grooved, pitted or scratched. If top crankshaft sealing surface is severely worn, replace crankshaft. If bottom crankshaft sealing surface is worn, replace crankshaft coupling seal.
4. Check all crankshaft bearing surfaces for rust, water marks, chatter marks, uneven wear and/or overheating (blued).
5. If necessary, "clean up" crankshaft bearing surfaces with crocus cloth.



57104

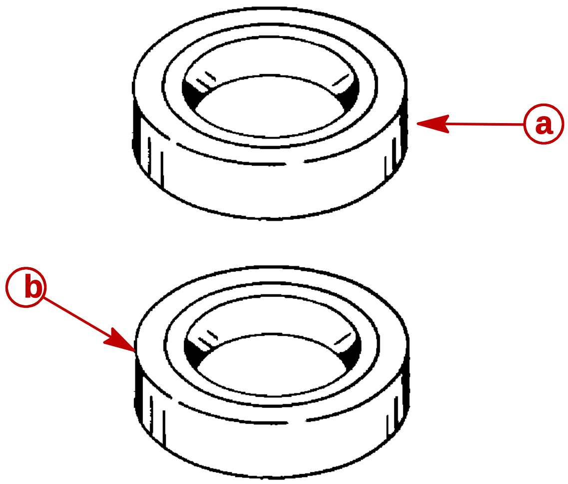
a - Crocus Cloth

6. Thoroughly clean crankshaft with solvent and dry with compressed air.
7. Recheck surfaces of crankshaft and replace crankshaft if surfaces can not be properly "cleaned up".
8. If crankshaft will be reused, apply light oil to prevent rust.

Seals

It is recommended that all seals be replaced as a standard rebuilding procedure.

NOTE: *Both top and bottom crankshaft seals face down when installed on crankshaft.*



53200

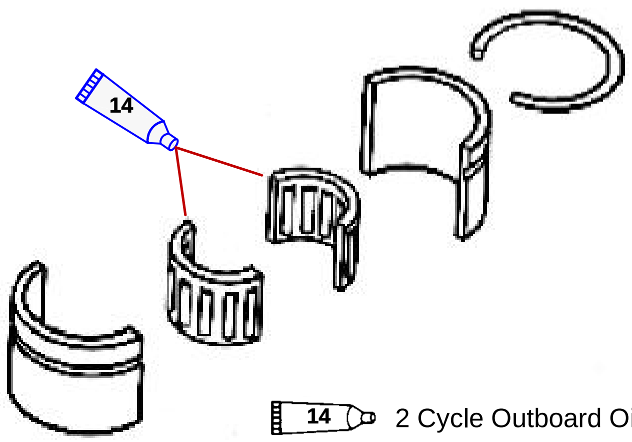
a **-** Top Crankshaft Seal
b **-** Bottom Crankshaft Seal

Bearings

ROLLER BEARINGS

1. Clean roller bearing with solvent and dry with compressed air.
2. Inspect roller bearing for rust, fracturing, wear, galling or overheating (blued). Always replace bearings as a set if replacement is necessary.
3. Apply light oil to bearings after inspection to prevent rust.

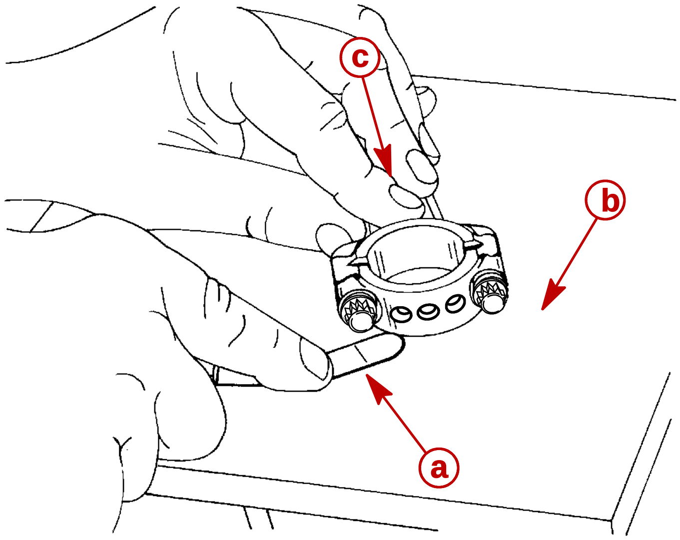
NOTE: *Use 2-4-C with Teflon to hold bearings in place while reassembling roller bearings to crankshaft.*



14 2 Cycle Outboard Oil (92-826666A24)

Connecting Rod

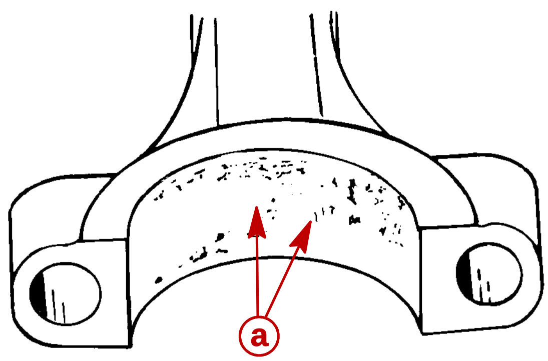
1. Check connecting rods for alignment by placing rods on a surface plate. If light can be seen under any portion of machined surfaces, if rod has a slight wobble on plate, or if a 0.002 in. (0.051 mm) feeler gauge can be inserted between any machined surface and surface plate, rod is bent and must be discarded.



57126

a - Feeler Gauge
b - Surface Plate
c - Even Downward Pressure

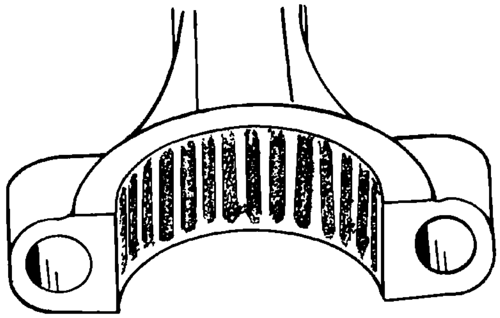
2. **Overheating:** Overheating is visible as a bluish bearing surface color that is caused by inadequate lubrication or excessive RPM.
3. **Rust:** Rust formation on bearing surfaces causes uneven pitting of surface(s).



51853

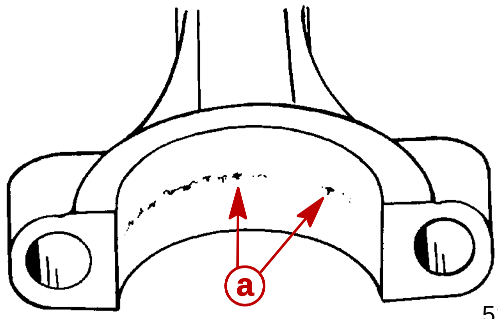
a - Pitting

4. **Water Marks:** When bearing surfaces are subjected to water contamination, a bearing surface "etching" occurs. This etching resembles the size of the bearing.



51853

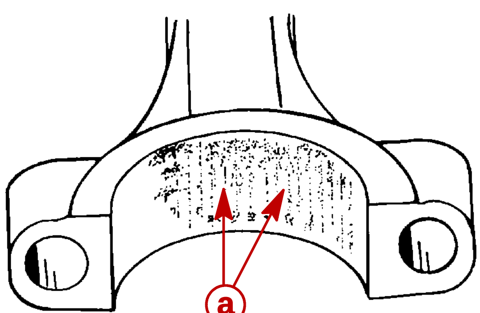
5. **Spalling:** Spalling is the loss of bearing surface, and it resembles flaking or chipping. Spalling will be most evident on the thrust portion of the connecting rod in line with the "I" beam. General bearing surface deterioration could be caused by or accelerated by improper lubrication.



51853

a - Spalling

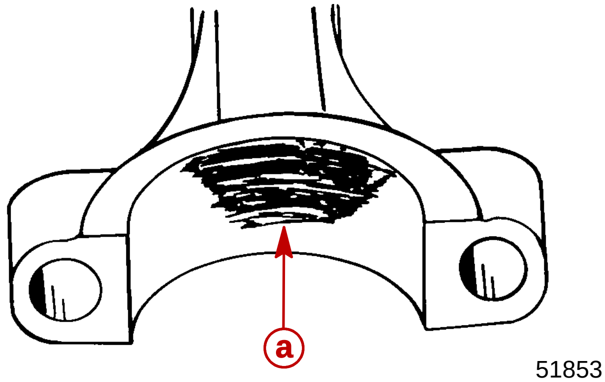
6. **Chatter Marks:** Chatter marks are the result of a combination of low speed - low load - cold water temperature operation, aggravated by inadequate lubrication and/or improper fuel. Under these conditions, the crankshaft journal is hammered by the connecting rod. As ignition occurs in the cylinder, the piston pushes the connecting rod with tremendous force, and this force is transferred to the connecting rod journal. Since there is little or no load on the crankshaft, it bounces away from the connecting rod. The crankshaft then remains immobile for a split second until the piston travel causes the connecting rod to catch up to the waiting crankshaft journal, then hammers it. The repetition of this action causes a rough bearing surface(s) which resembles a tiny washboard. In some instances, the connecting rod crank pin bore becomes highly polished. During operation, the engine will emit a "whirr" and/or "chirp" sound when it is accelerated rapidly from idle speed to approximately 1500 RPM, then quickly returned to idle. If the preceding conditions are found, replace both the crankshaft and connecting rod(s).



51853

a - Chatter Marks Between Arrows

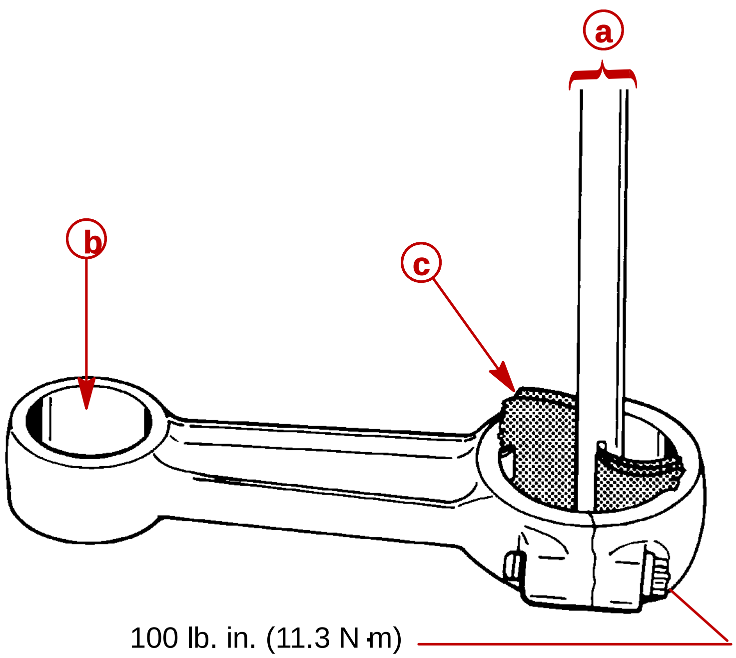
7. **Uneven Wear:** Uneven wear could be caused by a bent connecting rod.



a - Uneven Wear

⚠ CAUTION
Crocus cloth MUST BE USED to clean bearing surface at CRANKSHAFT END OF CONNECTING ROD. **320 grit Carborundum cloth MUST BE USED to clean bearing surface at PISTON PIN END OF CONNECTING ROD.** **VERIFY CAP TO ROD ALIGNMENT BEFORE TORQUING ROD BOLTS.** **DO NOT continue to clean connecting rod bearing surfaces after marks have been removed.**

NOTE: *Wash rod to remove abrasive grit and apply light oil to bearing surfaces to prevent rust.*

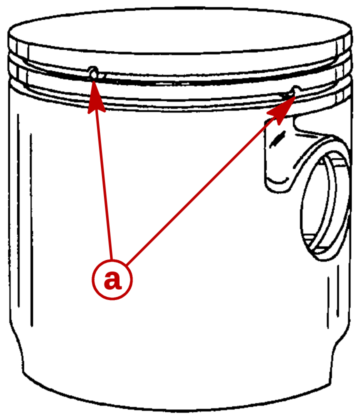


a - To Drill Motor
b - Use 320 Carborundum
c - Crocus Cloth

Pistons

IMPORTANT: If engine was submerged while engine was running, piston and/or connecting rod may be bent. If piston pin is bent, piston must be replaced. If piston pin is bent, connecting rod must be checked for straightness.

1. Inspect pistons for scoring and excessive piston skirt wear.
2. Check tightness of piston ring locating pins. Locating pins must be tight.



a - Locating Pins

3. Thoroughly clean pistons. Carefully remove carbon deposits from pistons, with a soft wire brush or carbon remove solution. Do not burr or round off machined edges.

Inspect piston ring grooves for wear and carbon accumulation. If necessary, scrape carbon from piston ring grooves **being careful not to scratch sides of grooves**. Refer to procedure following for cleaning piston ring grooves.

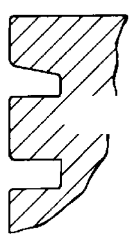
CLEANING PISTON RING GROOVES

Keystone (tapered) ring grooves

CAUTION
Care must be taken not to scratch the side surfaces of the ring groove. Scratching the side surface of the ring groove will damage the ring groove.

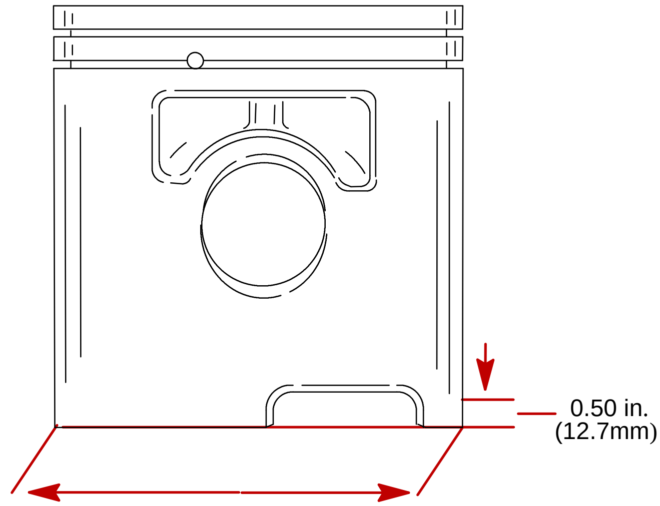
1. Use a bristle brush and carbon remover solution to remove carbon from side surfaces.
2. A tool can be made for cleaning the inner diameter of the tapered ring grooves. For the top ring groove, a tool can be made from a broken tapered piston ring with the side taper removed to enable the inside edge of the ring to reach the inner diameter of the groove. For the bottom ring groove, a tool can be made from a broken rectangular ring. Carefully scrape carbon from inner diameter of ring grooves. Care must be taken not to damage the grooves by scratching the side surfaces of the grooves.

Piston with 1 half keystone (half tapered) and 1 rectangular ring.



MEASURING PISTON

1. Measure piston skirt at right angle (90°) to piston pin centerline.



Standard Piston Diameter	
20/25/20 JET	2.5583 in– 2.5593 in. (64.98 mm – 65.00 mm)

PISTON CLEARANCE

MINIMUM BORE MEASUREMENT
– MAXIMUM PISTON MEASUREMENT

= PISTON CLEARANCE

PISTON CLEARANCE
0.003 in. – 0.004 in. (0.076 mm – 0.101 mm)

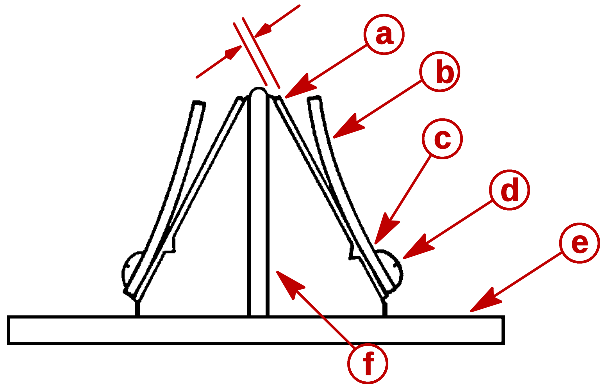
Reed Block

IMPORTANT: DO NOT remove reeds from reed block except for inspection purposes only. DO NOT turn used reeds over for reuse. If a reed block component is damaged, the entire reed block assembly must be replaced. Individual components are not sold separately.

1. Thoroughly clean reeds and reed block.
2. Check for wear (indentations), cracks or grooves on sealing surfaces of reed block that could cause leakage.
3. Check for chipped or broken reeds.
4. Inspect reed block seal for swelling or looseness. Replace reed block assembly if necessary.
5. If reeds have been removed, retorque screws to 25 lb. in. (2.8 N·m). Check reeds as outlined in "Reed Opening" and "Reed Stop Opening" following

REED OPENING

1. Check reeds for preload and stand open conditions. Stand open should not exceed 0.007 in. (0.178 mm). Replace reed block assembly if necessary.

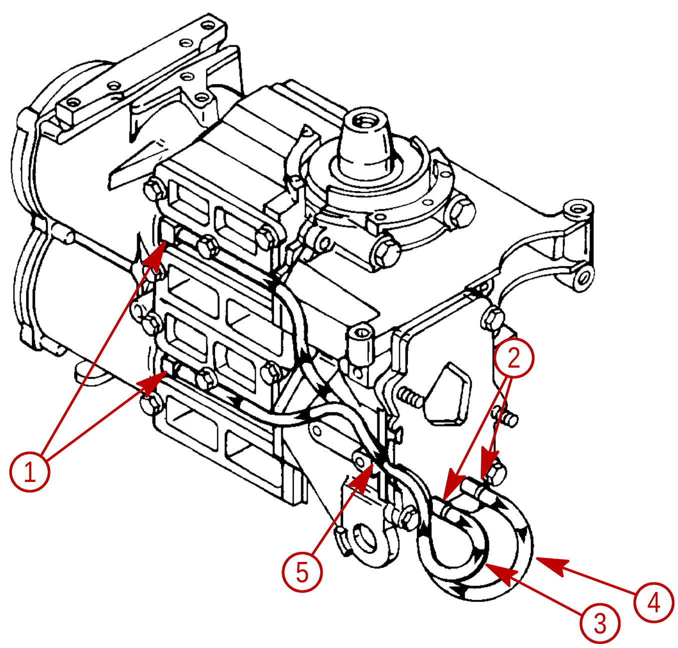


a - Reed
b - Reed Stop
c - Lock Washer
d - Screw
e - Reed Block
f - Seal (Vulcanized to Reed Block)

NOTE: *Reed Stop Opening is not adjustable.*

Bleed System

1. Inspect bleed hoses for deterioration. Replace hoses as required.
2. Inspect bleed valves in lower crankcase cover for proper function. Valve should flow fuel only one way – from bottom of crankcase cover to intake transfer port cover side of each cylinder. If check ball in valve is stuck open or closed, replace check valve.

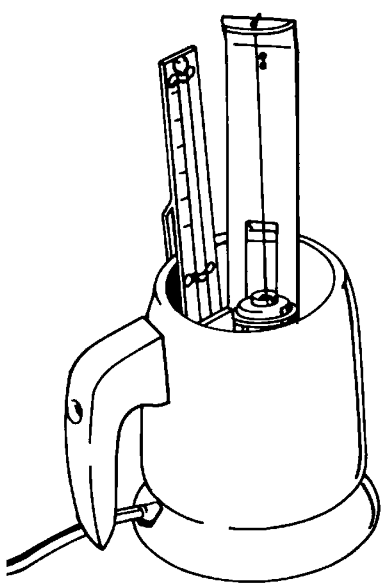


1 - 90° Fitting (2)
2 - Bleed Check Valves(2)
3 - Starboard Bleed Line (To Bottom 90° Fitting)
4 - Port Bleed Line (To Top 90° Fitting)
5 - Bleed hoses must be routed thru slot

Thermostat

Wash thermostat with clean water. Using a thermostat tester, similar to the one shown, test thermostat as follows:

- Open thermostat valve, then insert a thread between valve and thermostat body. Allow valve to close against thread.
- Suspend thermostat (from thread) and thermometer inside tester so that neither touches the container. Bottom of thermometer must be even with bottom of thermostat to obtain correct thermostat opening.
- Fill thermostat tester with water to cover thermostat.
- Plug tester into electrical outlet
- Observe temperature at which thermostat begins to open. Thermostat will drop off thread when it starts to open. Thermostat must begin to open when temperature reaches 5°F (3°C) above designated stamping on bottom of thermostat.
- Continue to heat water until thermostat is completely open.
- Unplug tester unit.
- Replace thermostat, if it fails to open at the specified temperature, or if it does not fully open.



51087

Powerhead Reassembly

General Information

Before proceeding with powerhead reassembly, be sure that all parts to be reused have been carefully cleaned and thoroughly inspected, as outlined in "Cleaning and Inspection". Parts, which have not been properly cleaned (or which are questionable), can severely damage an otherwise perfectly good powerhead within a few minutes of operation. All new powerhead gaskets must be installed during assembly.

During reassembly, lubricate parts with Quicksilver 2-Cycle Outboard Oil whenever 2-cycle oil is specified, and Quicksilver 2-4-C w/Teflon Marine Lubricant whenever grease is specified.

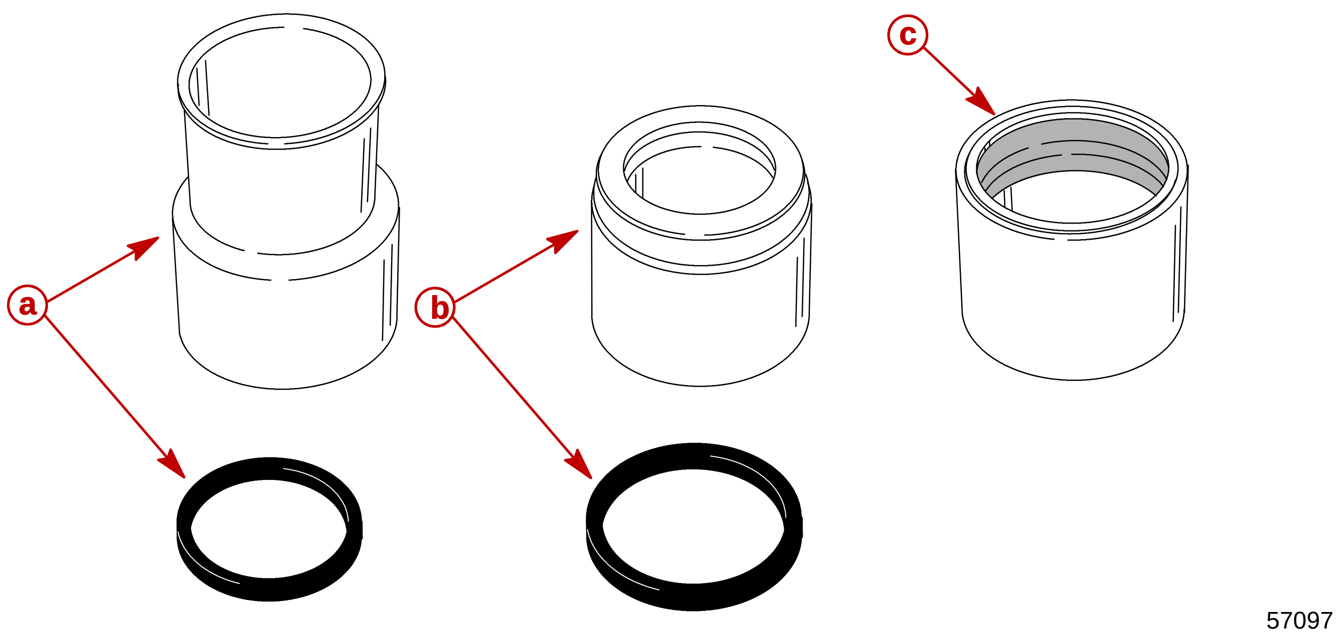
CAUTION

Any GREASE used for bearings INSIDE the powerhead MUST BE gasoline soluble. Use only Quicksilver 2-4-C w/Teflon Marine Lubricant or Quicksilver Needle Bearing Assembly Lubricant. The use of any other grease may result in powerhead damage.

A torque wrench is essential for correct reassembly of powerhead. Do not attempt to reassemble powerhead without using a torque wrench.

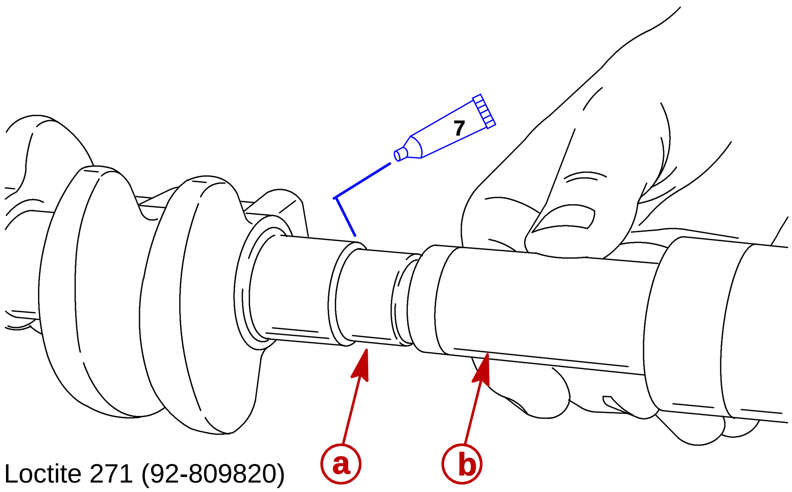
Crankshaft

NOTE: *Three designs of crankshaft seals have been used. Design 3 is the current application.*



a - Design 1 – O-ring fits in groove on driveshaft
b - Design 2 – O-ring fits inside of carrier
c - Design 3 – 3 lip seal permanently installed inside of carrier

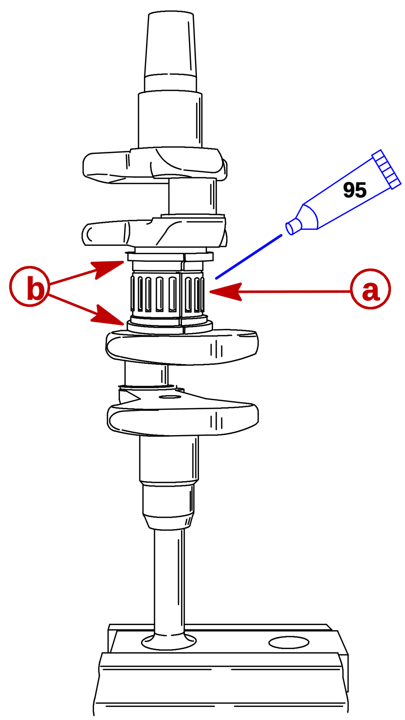
1. If removed, reinstall new crankshaft carrier as follows:
   a. Apply a thin coat of Loctite 271 to carrier surface on crankshaft.
   b. Square the carrier with crankshaft and using a 7/8 in. deep well socket and hammer, carefully seat carrier onto crankshaft.



7 Loctite 271 (92-809820)

a - Carrier
b - 7/8 in. deep well socket

2. Apply 2-4-C w/Teflon to crankshaft roller bearings and thrust washers to hold components in place on crankshaft while reassembling.
3. Install roller bearings and thrust washers onto crankshaft.



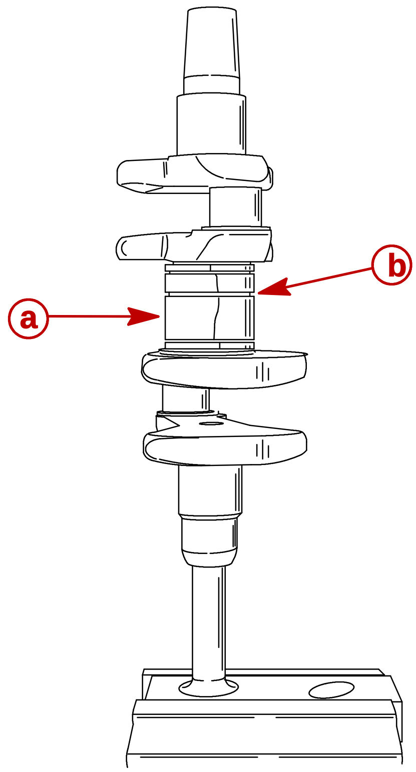
95 2-4-C With Teflon (92-825407A12)

a - Race Halves with Roller Bearings
b - Thrust Washers

NOTE: *Bearing race halves retainer ring groove faces toward flywheel end of crankshaft.*

4. Reinstall bearing race halves. Secure halves with retainer ring.

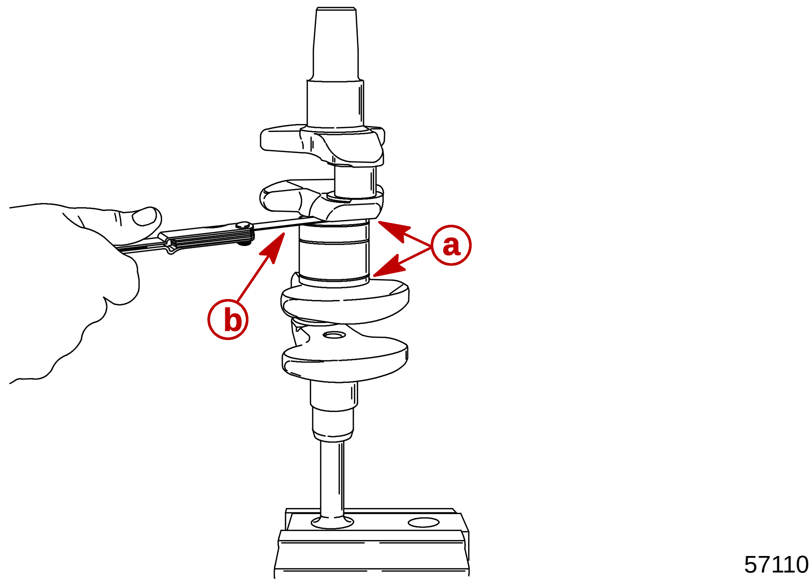
NOTE: *Install retainer ring so that ring bridges both fracture lines of bearing race.*



57109

a - Race Halves
b - Retainer Ring

5. Check center main thrust washers for wear as follows:
   a. Push thrust washers and center main bearing toward either end of crankshaft.
   b. Use a feeler gauge and check clearance between crankshaft and thrust washers.
   c. If clearance between crankshaft and thrust washers is greater than 0.030 in. (0.762 mm), replace thrust washers.

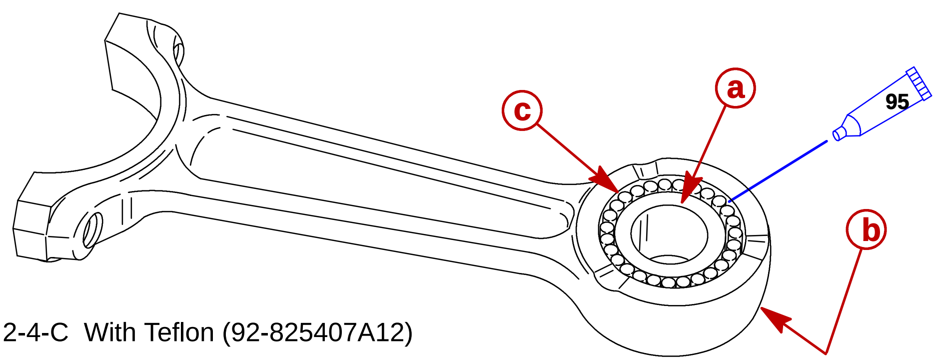


a - Thrust Washers
b - Feeler Gauge

NOTE: *It is recommended that the piston pin and piston be installed on the connecting rod prior to installing the connecting rod on the crankshaft to avoid possible bending of the rod during piston pin installation.*

IMPORTANT: When replacing needle bearings, replace all needles as a set. Do not use old and new needles together.

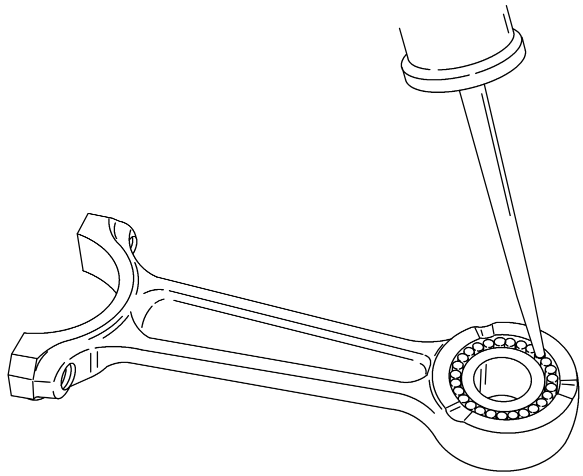
6. Install piston onto connecting rod as follows:
   a. Lubricate sleeve of Piston Pin Tool (91-76160A2) with 2-4-C w/Teflon Marine Lubricant (92-825407A12).
   b. Hold lower locating washer and sleeve onto piston pin bore of connecting rod and install needle bearing set of 27.



95 2-4-C With Teflon (92-825407A12)

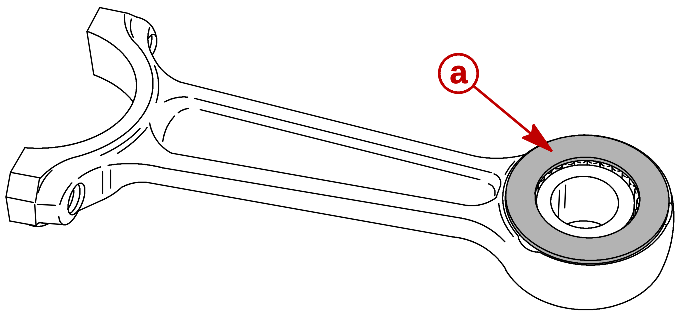
a - Sleeve
b - Locating Washer
c - Needle Bearings (27)

NOTE: *If the tip of an awl can be inserted between the needle bearings, one or more needles are missing and must be replaced.*



57111

c. Install upper locating washer.

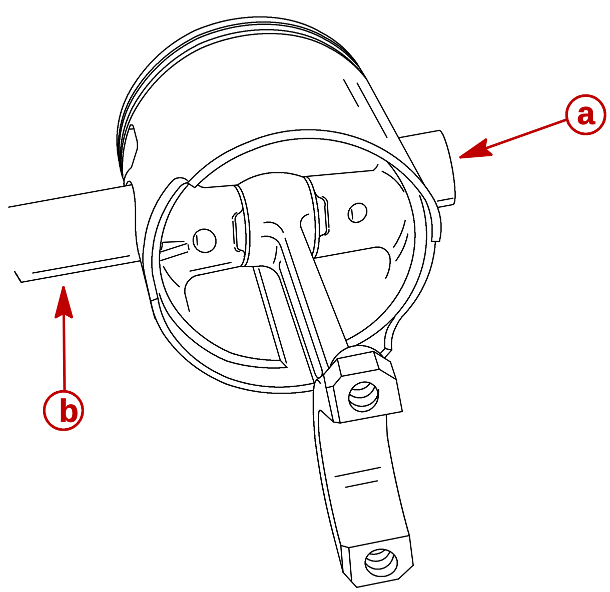


57113

a - Locating Washer

d. Slide piston onto connecting rod, centering piston pin bore over sleeve.

e. Slide piston tool up thru piston pin bore and remove sleeve.

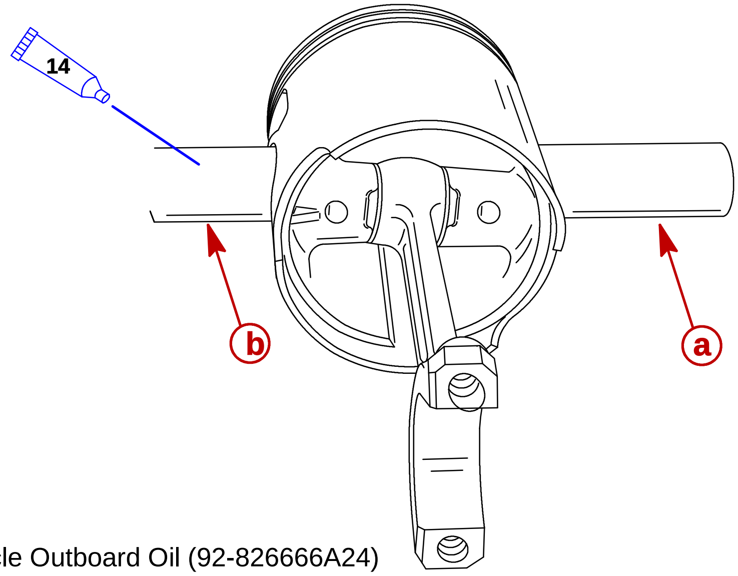


57114

a - Sleeve

b - Piston Pin Tool (91-76160A2)

f. Apply light oil to piston pin and place piston pin onto tool.



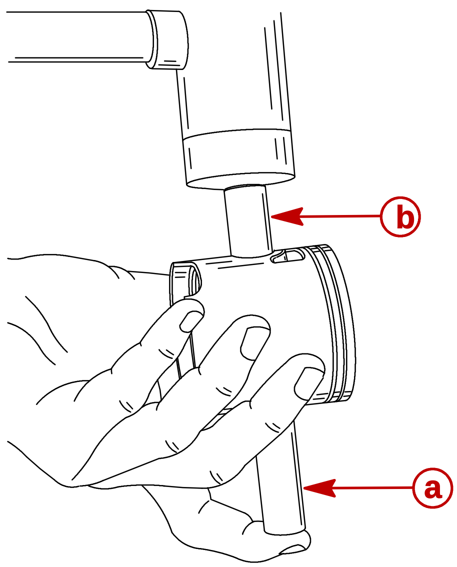
14 2 Cycle Outboard Oil (92-826666A24)

57115

a - Piston Pin
b - Piston Pin Tool (91-76160A2)

g. Support bottom of piston and hold piston pin tool up against piston pin.

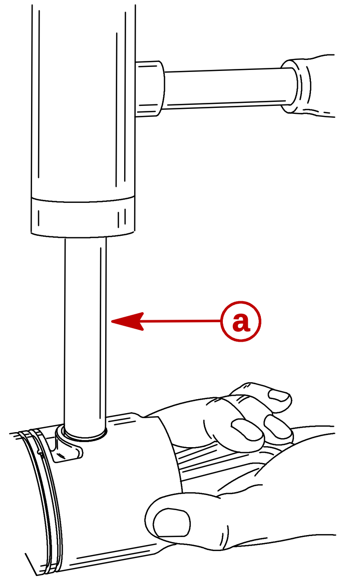
h. Drive piston pin into piston pin bore (with a soft face mallet) until pin is flush with piston.



57100

a - Piston Pin Tool (91-76160A2)
b - Piston Pin

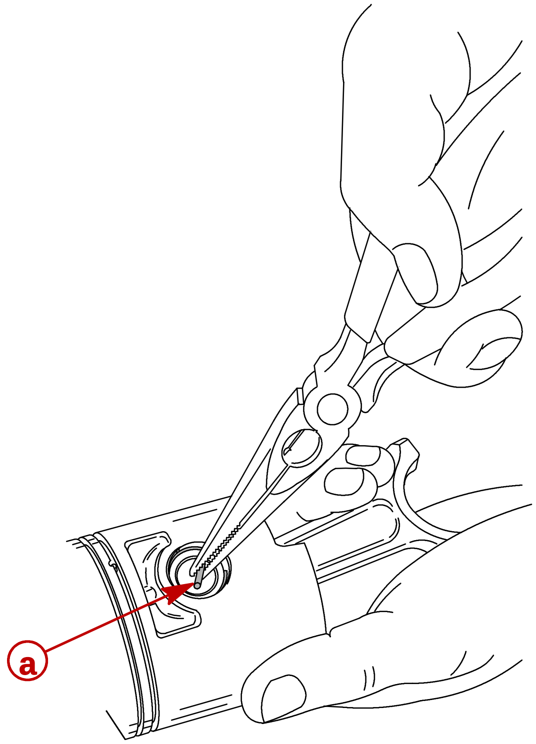
i. Move piston pin tool to top of piston pin bore and center piston pin in piston.



57116

a - Piston Pin Tool (91-76160A2)

7. Install new lockrings into grooves in both ends of piston pin bore.



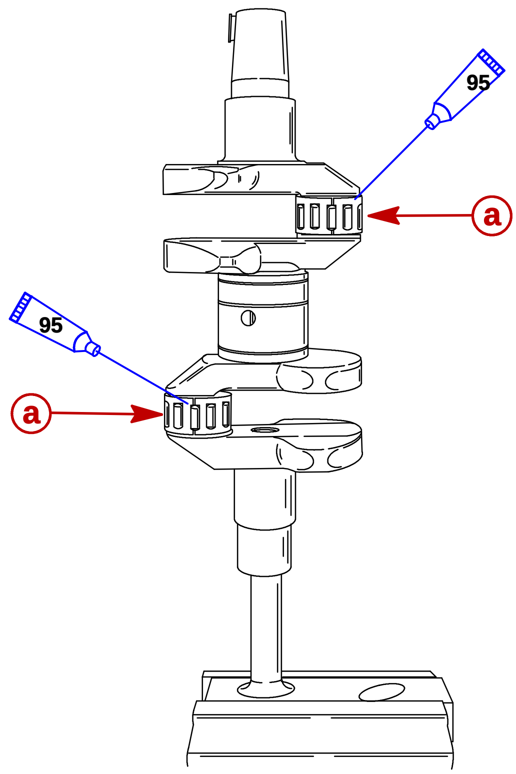
37117

a - Lockring

8. Install connecting rods onto crankshaft as follows:
   a. Apply 2-4-C w/Teflon Marine Lubricant to connecting rod big-end bearings.

IMPORTANT: Replace roller bearing halves as a set. DO NOT use old and new halves together.

   b. Place both halves of connecting rod big-end roller bearing onto crank pin.



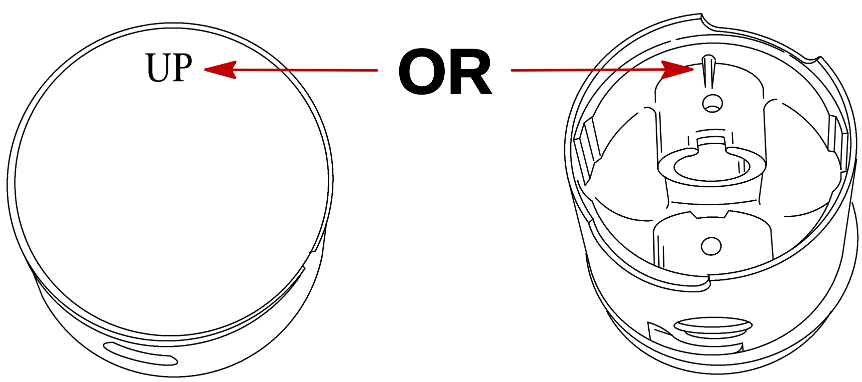
95 2-4-C With Teflon (92-825407A12)

57118

a - Roller Bearing

⚠ CAUTION

The word “UP” (cast on the outside of piston) must be toward flywheel end of crankshaft when installing piston/rod assembly onto crankshaft. Failure to orient piston/rod assembly correctly on crankshaft will result in piston rings catching in ports causing powerhead damage. If “UP” is not present on top of piston, raised rib on wrist pin boss must face up towards flywheel end of crankshaft.

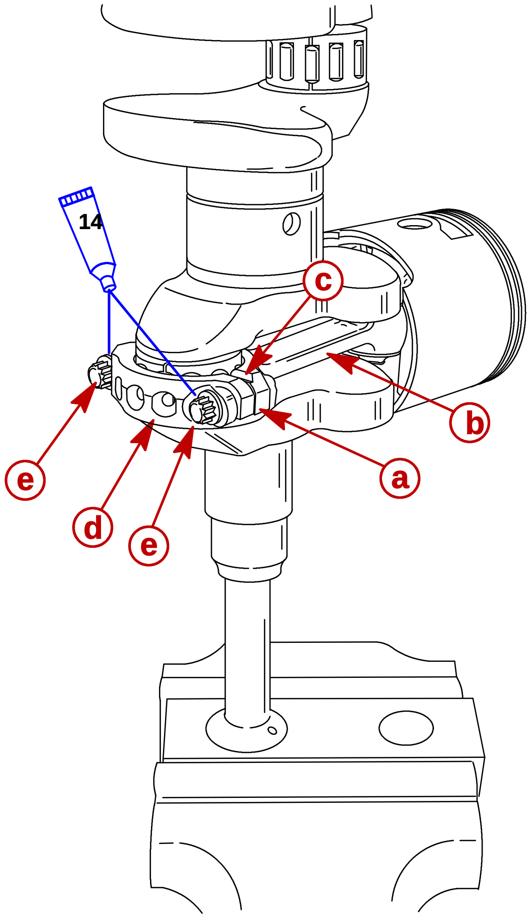


57096

57095

IMPORTANT: Clean connecting rod bolts with solvent and dry with compressed air. Inspect threads for damage. If threads are not damaged, bolts may be reused. Apply light oil to threads prior to installation.

c. Observe connecting rod/cap fracture line for correct alignment. Secure connecting rod (with v-notch of rod toward flywheel end of crankshaft) onto crankshaft with rod cap and bolts. Torque bolts to 150 lb. in. (16.9 N·m).

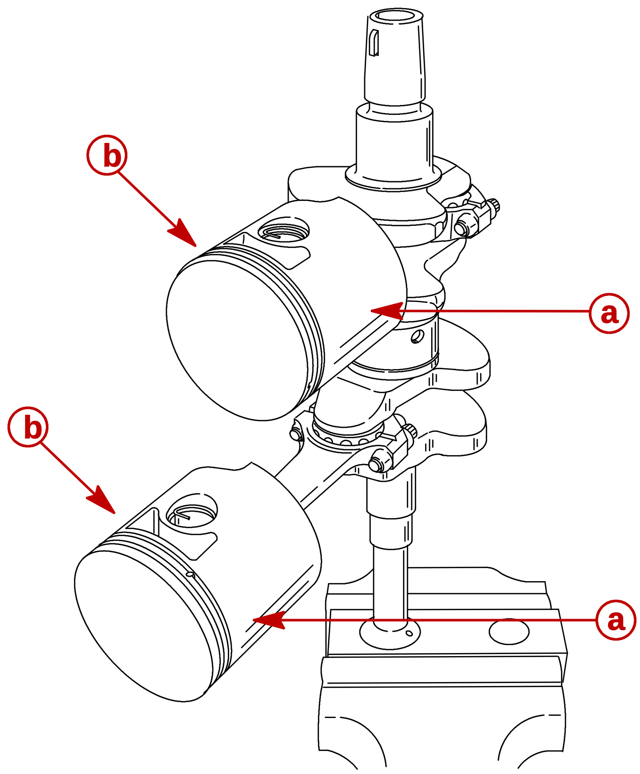


14 2 Cycle Outboard Oil (92-826666A24)

57119

a - Fracture Line
b - Connecting Rod
c - V-Notch (Toward Flywheel)
d - Rod Cap
e - Bolts – Torque to 150 lb. in. (16.9 N·m)

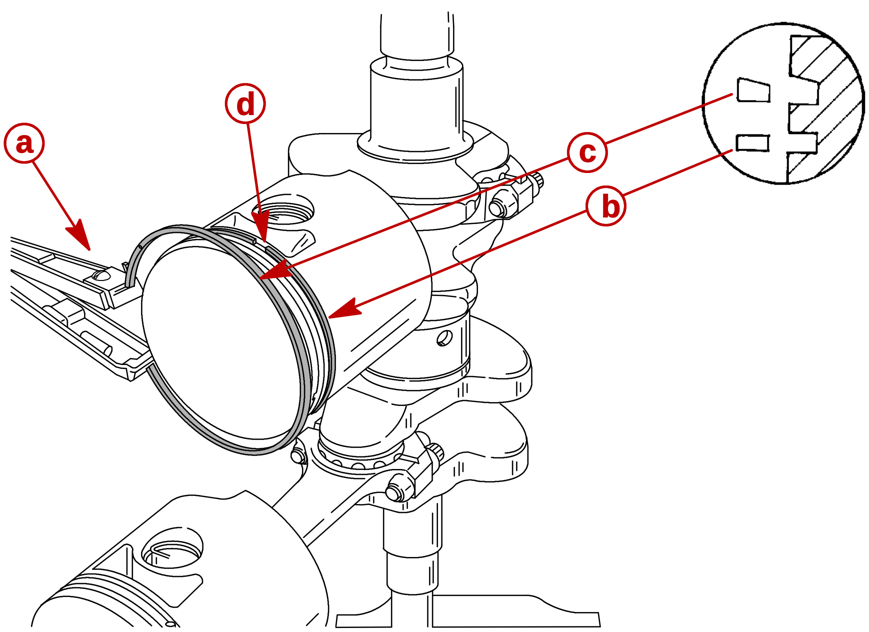
d. Correct piston installation:



57120

a - Intake Side
b - Exhaust Side

9. Install new piston rings using Piston Ring Expander (91-24697). Install RECTANGULAR ring first in bottom ring groove. Install HALF-KEYSTONE ring in top ring groove. Align piston rings with each respective ring groove locating pin.

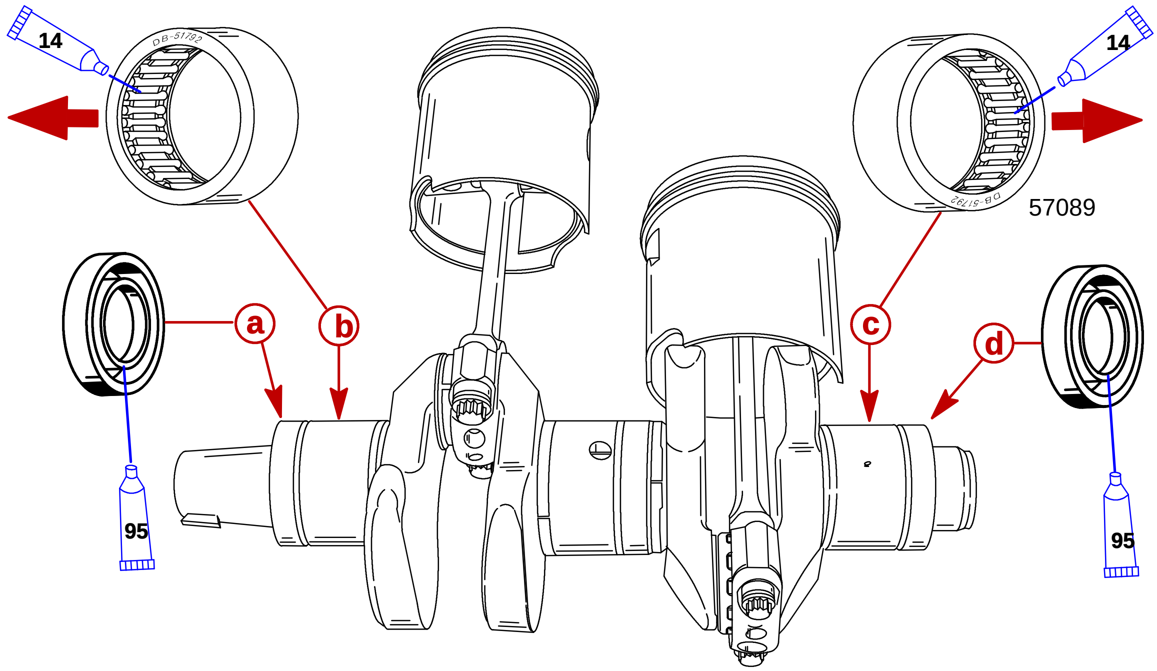


57121

a - Piston Ring Expander (91-24697)
b - Rectangular Ring
c - Half-Keystone Ring
d - Locating Pin

10. Apply outboard oil to upper and lower roller bearings and install bearings on crankshaft. Numbered side of bearing should face UP or OUT on bearings.

11. Install new upper and lower crankshaft seals. Both seal lips face down. Apply 2-4-C w/Teflon to seal lips.



14 2 Cycle Outboard Oil (92-826666A24)

95 2-4-C With Teflon (92-825407A12)

57089

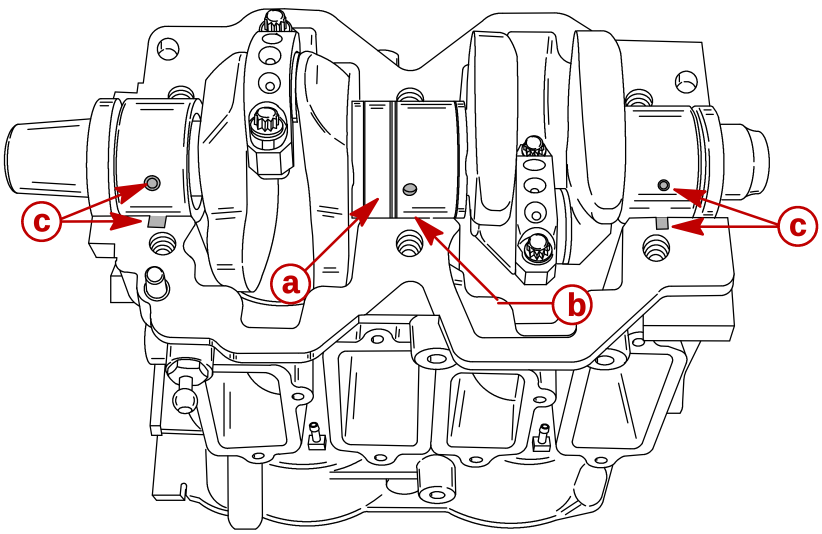
a - Upper Crankshaft Seal
b - Upper Crankshaft Bearing (Numbers/letters face up/out)
c - Lower Crankshaft Bearing (Numbers/letters face down/out)
d - Lower Crankshaft Seal

Cylinder Block

CAUTION

Piston rings must be properly positioned with locating pin between piston ring end gaps. Improperly positioned piston rings will break during installation.

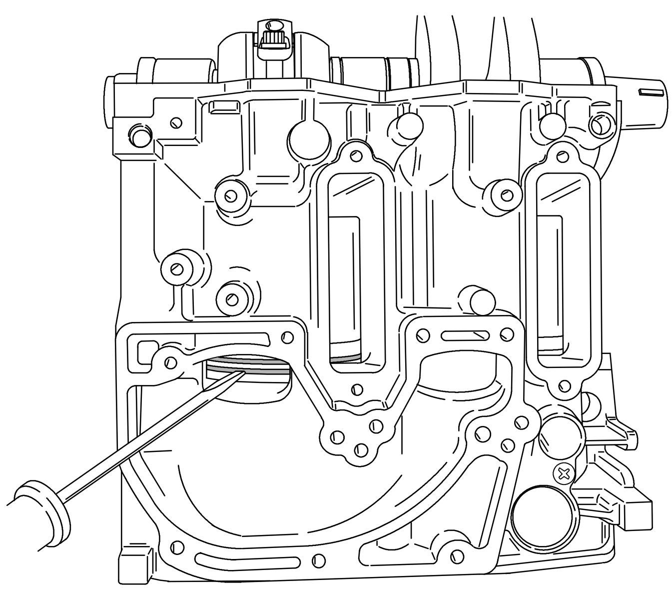
1. Lubricate piston rings, piston and cylinder wall with light oil.
2. Keeping crankshaft horizontal, guide pistons into cylinder bores.
3. Align hole in center main bearing race with pin of cylinder block.



57122

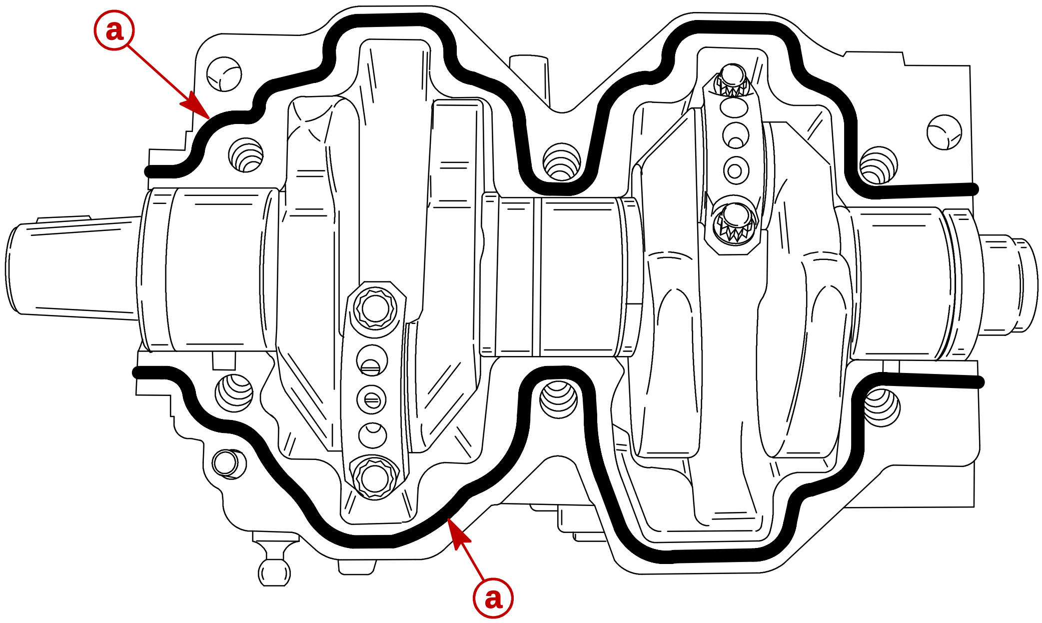
a - Hole
b - Pin (Hidden)
c - Align Pin In Slot

4. Position alignment boss of upper crankshaft roller bearing into notch in cylinder block.
5. Gently push seals inward to seat.
6. Check each piston ring for spring tension thru transfer and exhaust ports by pressing with a screwdriver. If no spring tension exists (ring fails to return to position), it is likely that the piston ring was broken during assembly [replace broken piston ring(s)]. Use caution not to burr piston rings while inspecting.



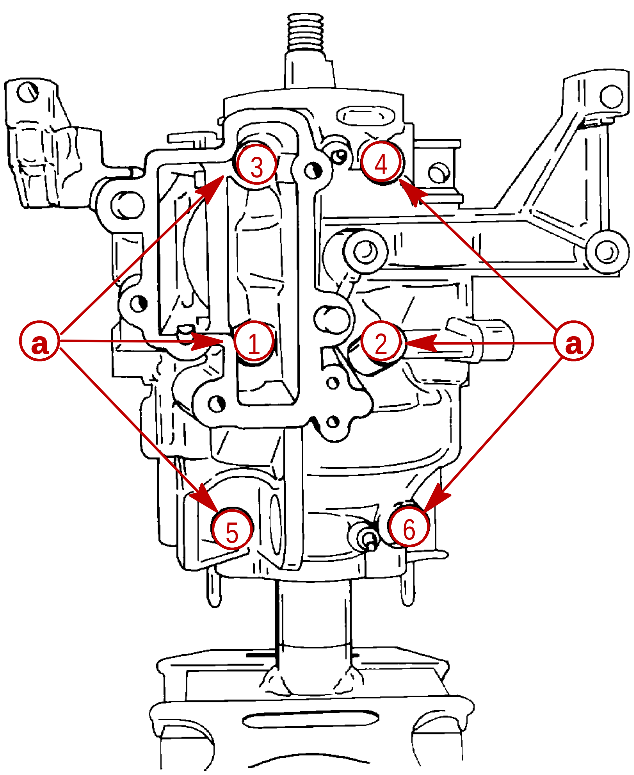
57124

7. Clean crankcase sealing surfaces according to Loctite Master Gasket instructions. Apply a continuous bead of Loctite sealant along the inside of the mounting bolt holes of crankcase cover.



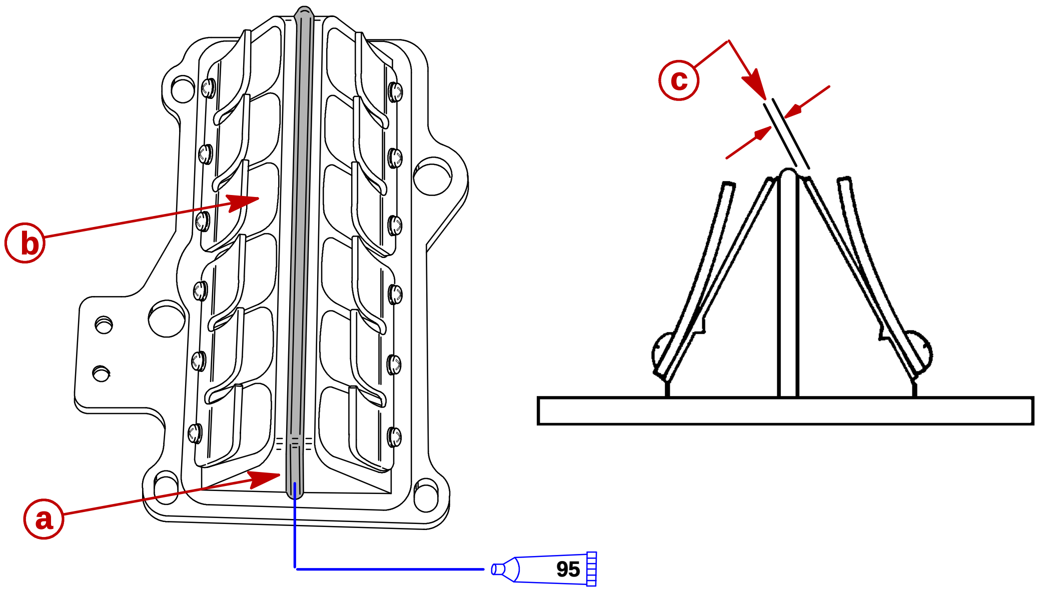
a - Sealant

8. Place crankcase cover onto cylinder block and secure with 6 bolts. Torque bolts to 30.0 lb. ft. (40.7 N·m) in numbered torque sequence.



a - Bolts – Torque to 16.7 lb. ft. (22.7 N·m)

9. Rotate crankshaft several times to assure free operation.
10. If disassembled, assemble reed block as follows:
    a. Torque reed stop screws to 25 lb. in. (2.8 N·m)
    b. Lubricate seal with 2-4-C w/Teflon and install reed block onto cylinder block.

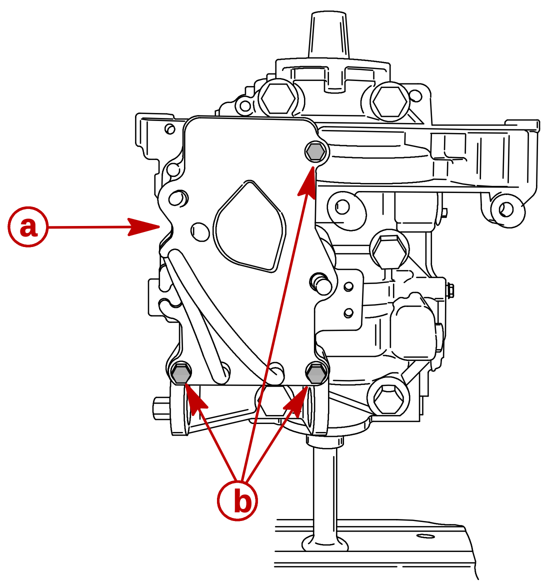


95 2-4-C With Teflon (92-825407A12)

57080

a - Screws [Torque to 25 lb. in. (2.8 N·m)]
b - Seal
c - Reed Valve Opening – Maximum Opening 0.007 in. (0.178 mm)

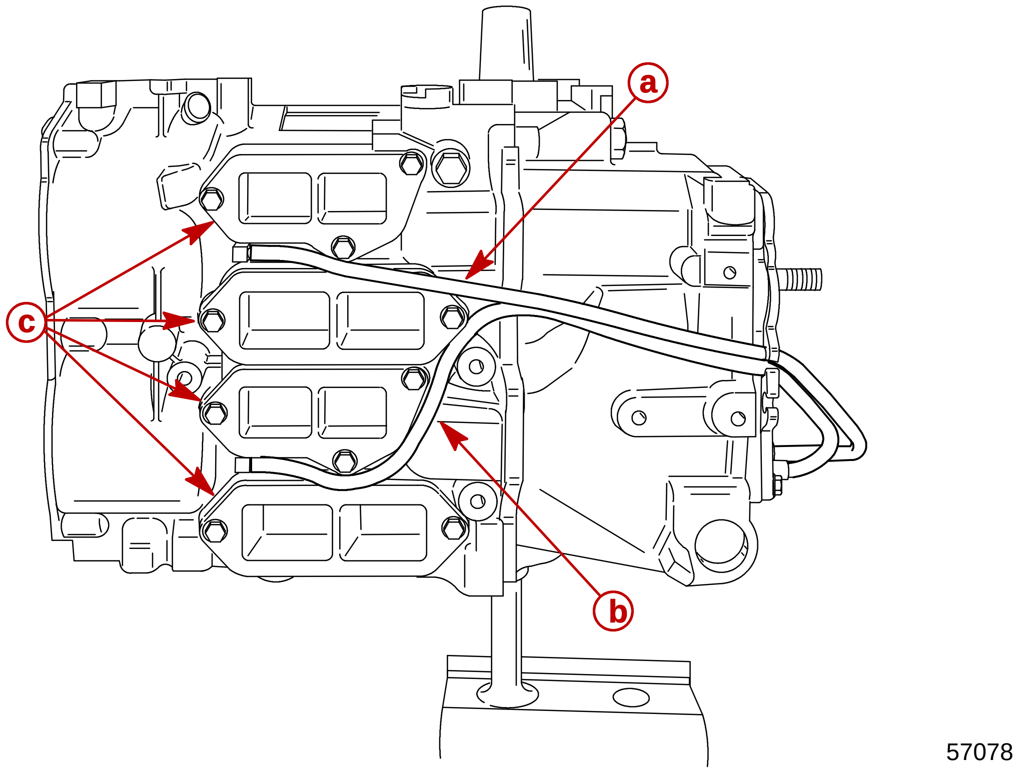
11. Secure carburetor adaptor plate with new gasket to cylinder block with 3 bolts. Torque bolts to 80 lb. in. (9.0 N·m).



57079

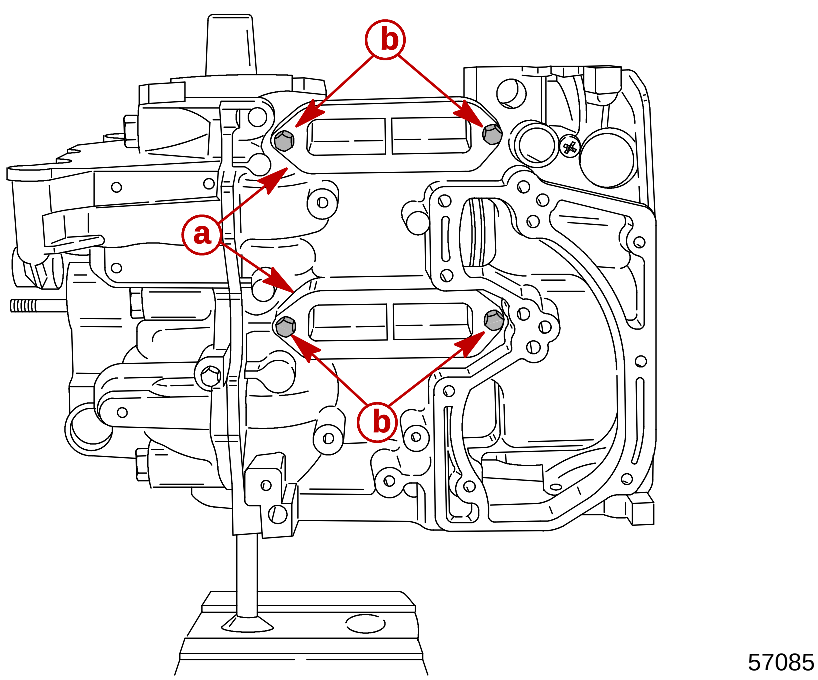
a - Adaptor Plate
b - Bolts – Torque to 80 lb. in. (9.0 N·m)

12. Route upper and lower bleed hoses to their respective fittings as shown.
13. Install starboard transfer port covers with new seals. Torque attaching bolts to 40 lb. in. (9.0 N·m).



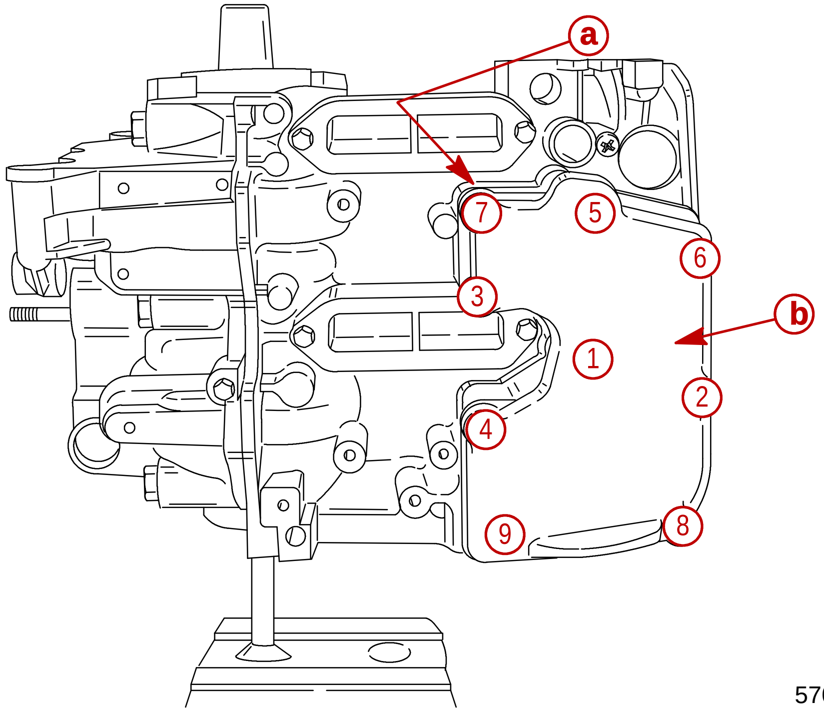
a - Upper Bleed Hose
b - Lower Bleed Hose
c - Transfer Port Covers

14. Install transfer port covers with new seals. Torque attaching bolts to 40 lb. in. (4.5 N·m).



a - Transfer Port Covers
b - Bolts – Torque to 40 lb. in. (4.5 N·m)

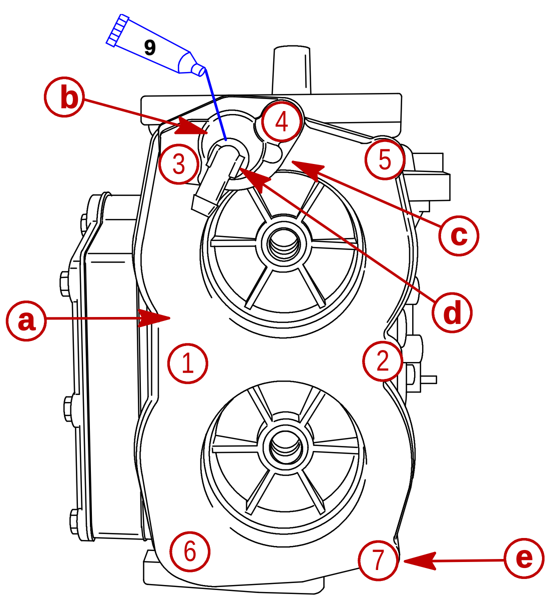
15. Install exhaust manifold and exhaust cover with new gaskets. Torque bolts to 140 lb. in. (15.8 N·m) in torque sequence shown.



a - Exhaust Manifold
b - Exhaust Cover

16. Install cylinder block cover with thermostat and new gaskets. Torque bolts to 140 lb. in. (15.8 N·m) in torque sequence shown.

NOTE: *If tell-tale elbow fitting is removed/replaced at thermostat cover, apply Loctite PST Pipe Sealant to threads of elbow fitting prior to installation*



9 Loctite PST Pipe Sealant (92-809822)

57081

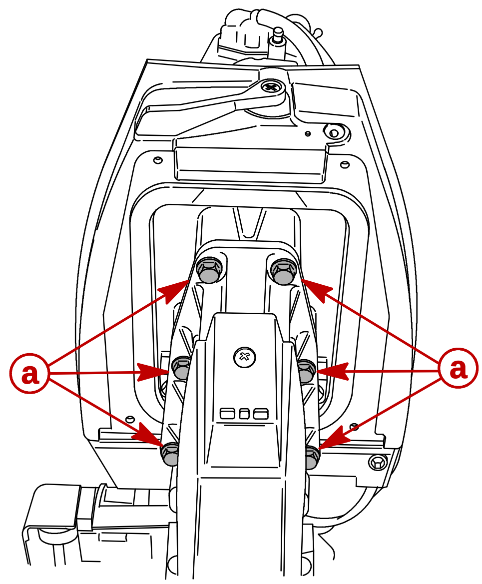
a - Cylinder Block Cover
b - Thermostat (Under Cover)
c - Gasket
d - Elbow
e - Bolts – Torque to 140 lb. in. (15.8 N·m)

Powerhead Installation

1. Verify powerhead base surface and driveshaft housing mating surfaces are free of old gasket material.
2. Install powerhead with new gasket onto driveshaft housing.

NOTE: *It may be necessary to rotate propeller shaft slightly to align crankshaft splines with driveshaft splines.*

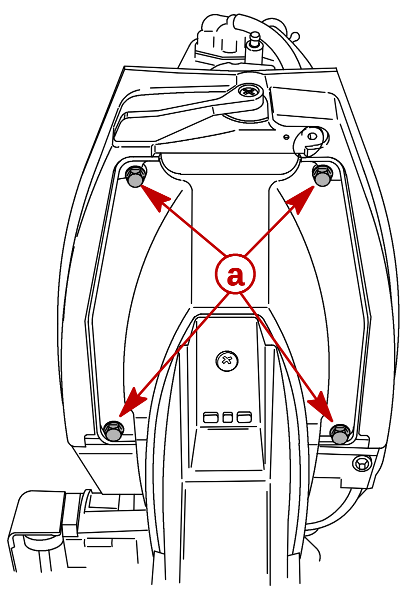
3. Secure powerhead to driveshaft with 6 bolts. Torque bolts to 20 lb. ft. (27.1 N·m).



57077

a - Bolts [Torque to 20 lb. ft. (27.1 N·m)]

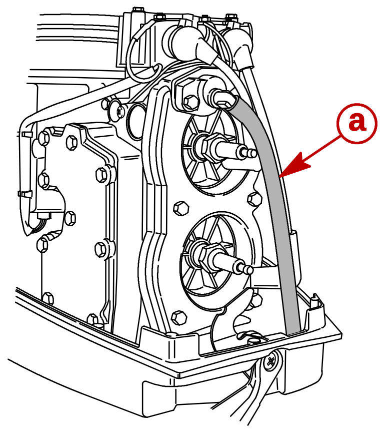
4. Reinstall trim cover. Torque bolts to 85 lb. in. (9.6 N·N·m).



57076

a - Bolts – Torque to 85. lb. in. (9.6 N·m)

5. Install tell-tale hose and attach hose to fitting on bottom cowl.



a - Tell-Tale Hose

6. Install the following components/assemblies referring to the listed service manual sections.

Component/Assembly	Section
Carburetor	3A
Throttle/Shift Mechanism	7A/B/C
Electrical/Ignition Components and Flywheel	2A/B
Rewind Starter	8

Set-Up and Test-Run Procedures

CAUTION

When engine is started, IMMEDIATELY check for fuel leaks and water leaks. Check for water pump operation by water being discharged from tell-tale.

1. Following powerhead repairs, refer to Section 2C "Timing/Synchronizing/Adjusting" and perform set-up procedures.
2. While test running engine, check powerhead assembly for leaks and/or unusual noises. Make any repairs BEFORE returning engine to service.

Break-In Procedure

CAUTION

To avoid possible engine damage, break-in procedure MUST BE completed BEFORE operating engine continuously at full throttle. Failure to break-in engine in properly will result in engine failure or shortened powerhead life.

IMPORTANT: Advise the owner that the break-in procedure must be followed EXACTLY when returning an overhauled engine to service.

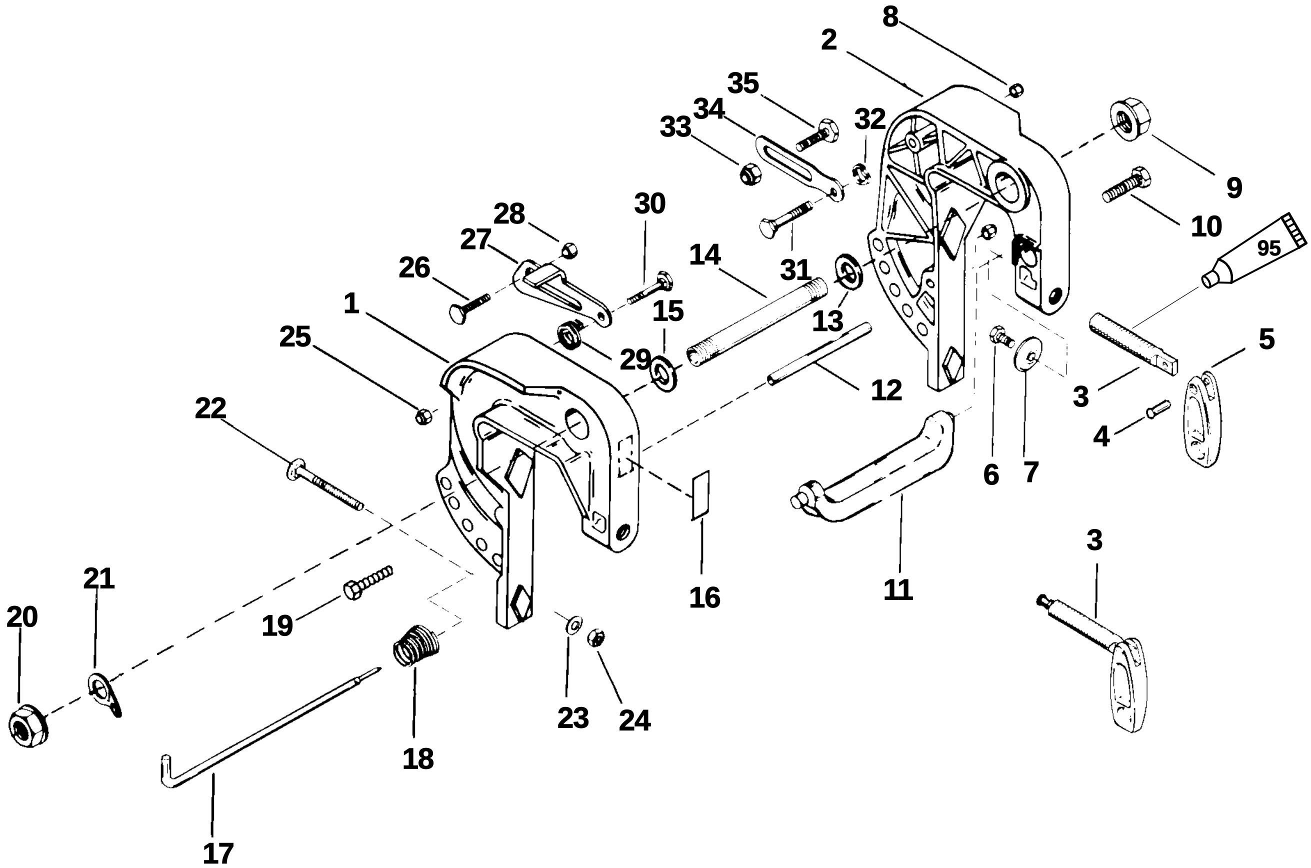
1. Mix gasoline and oil at the normal 50:1 ratio.
2. Operate engine at varied throttle settings for the first hour (1 hour). AVOID both wide-open-throttle operation and prolonged idle in cold water areas during this period.
3. After the first hour of operation, the engine is may be run at any speed. DO NOT EXCEED the full throttle RPM range listed in "Specifications", preceding.

MIDSECTION

Section 5 - CLAMP and SWIVEL BRACKET

Table of Contents

Clamp Bracket Assembly

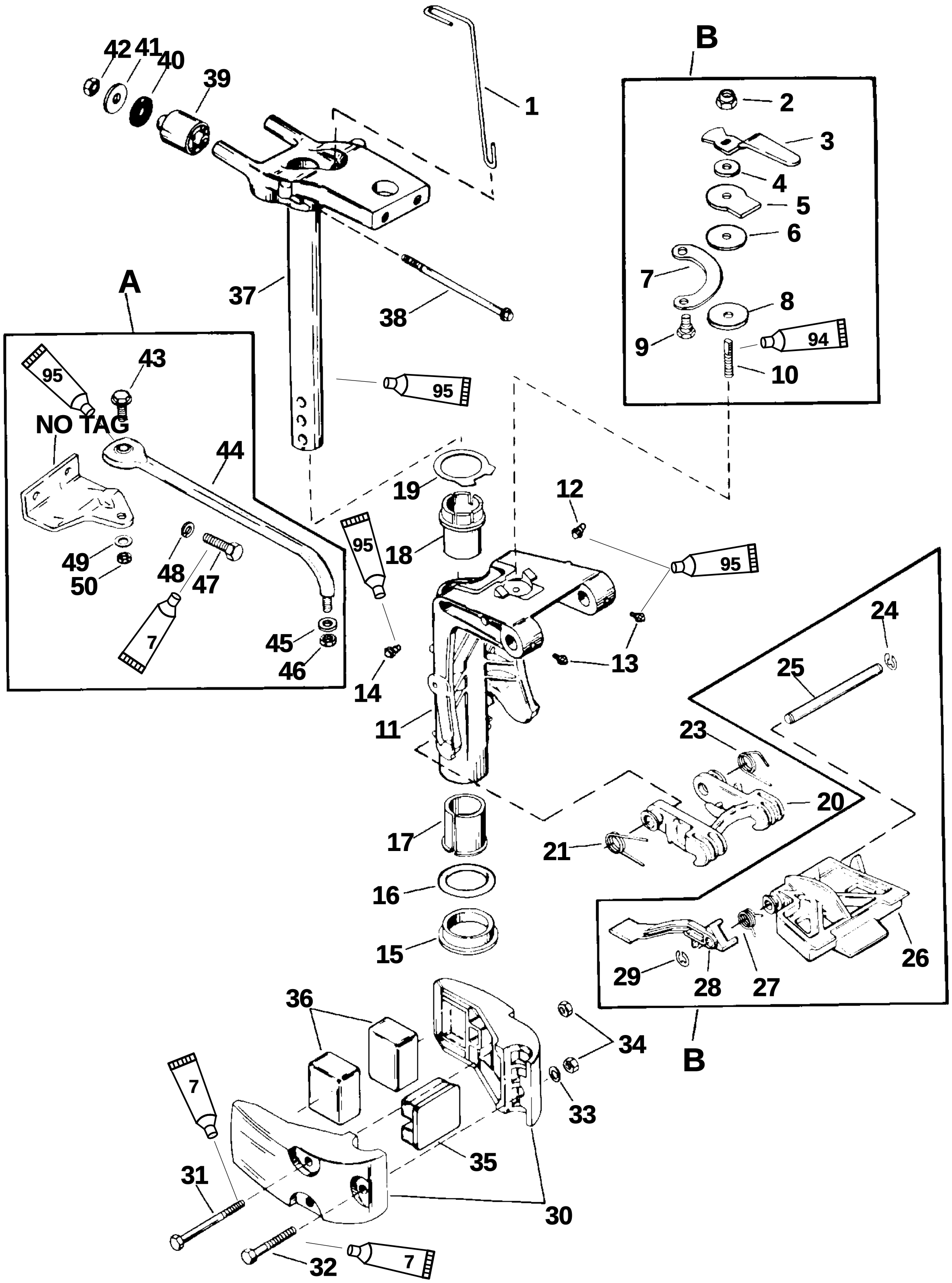


95 2-4-C With Teflon (92-825407A12)

Clamp Bracket Assembly

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	CLAMP BRACKET **(STBD.) (BLACK)**			
	1	CLAMP BRACKET **(STBD.) (GRAY)**			
	1	CLAMP BRACKET **(STBD.) (TRACKER GRAPHITE GRAY)**			
2	1	CLAMP BRACKET **(PORT) (BLACK)**			
	1	CLAMP BRACKET **(PORT) (GRAY)**			
	1	CLAMP BRACKET **(PORT) (TRACKER GRAPHITE GRAY)**			
3	2	THUMB SCREW ASSEMBLY			
4	2	RIVET			
5	2	HANDLE			
6	2	SCREW–washer attaching	140	12.0	15.8
7	2	WASHER–thumb screw			
8	1	NUT (1/4-28)	65		7.3
9	1	NUT (7/8-14)	120	10.0	13.6
10	1	SCREW (M6x1x40)	140	12.0	15.8
11	1	HANDLE–carrying			
12	1	SPACER			
13	1	WASHER–tilt tube (NYLON)			
14	1	TILT TUBE			
15	1	WASHER–tilt tube (NYLON)			
16	1	DECAL–co-pilot			
17	1	TILT PIN ASSEMBLY			
18	1	SPRING			
19	1	SCREW (M6x1x40)	140	12.0	15.8
20	1	NUT (7/8-14)	120	10.0	13.6
21	1	CLIP–safety			
22	2	BOLT–clamp bracket to transom			
23	2	WASHER–clamp bracket bolt			
24	2	NUT–clamp bracket bolt			
25	1	NUT (1/4-28)	65		7.3
26	1	SCREW (1/4-28x1 IN.)	65		7.3
27	1	LEVER–tilt stop - starboard side			
28	1	NUT (1/4-28)	65		7.3
29	1	SPRING–tilt stop lever screw			
30	1	SCREW (1/4-28x1-3/4 IN.)	65		7.3
31	1	SCREW (1/4-28x1-3/4 IN.)	65		7.3
32	1	WAVE WASHER–tilt stop strap screw			
33	1	NUT (1/4-28)	65		7.3
34	1	STRAP–tilt stop - port side			
35	1	SCREW (1/4-28x1 IN.)	65		7.3

Swivel Bracket Assembly



7 Loctite 271 (92-809820)

94 Anti-Corrosion Grease (92-78376A6)

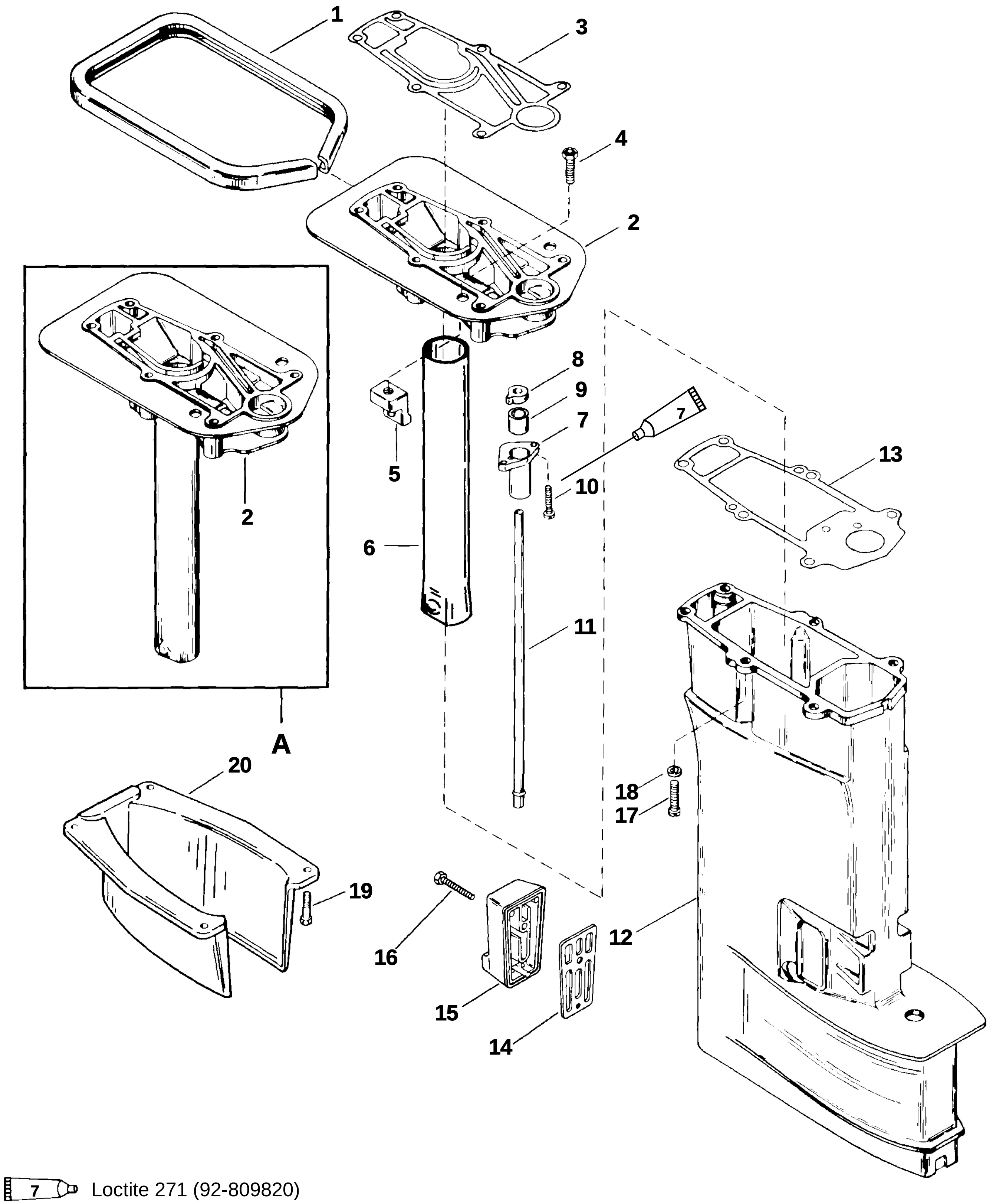
95 2-4-C With Teflon (92-825407A12)

A=REMOTE CONTROL MODELS ONLY B=TILLER HANDLE MODELS ONLY

Swivel Bracket Assembly

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	ROD–reverse hook			
2	1	NUT	125		14.1
3	1	HANDLE			
4	1	WASHER			
5	1	BRAKE PLATE			
6	1	BRAKE DISC			
7	1	SWIVEL HEAD PLATE (Included W/Ref. #36)			
8	1	BRAKE DISC			
9	2	SCREW (M6x1x14) (Included W/Ref. #36)	140	12.0	15.8
10	1	ROD			
11	1	SWIVEL BRACKET			
12	1	GREASE FITTING	35		4.0
13	2	GREASE FITTING	35		4.0
14	1	GREASE FITTING	35		4.0
15	1	BUSHING KIT			
16	1	O-RING			
17	1	BUSHING			
18	1	BUSHING			
19	1	WASHER			
20	1	HOOK ASSEMBLY–reverse lock			
21	1	SPRING **(REMOTE CONTROL MODELS)**			
22	1	SPRING **(ALL OTHER MODELS)**			
23	1	SPRING			
24	1	RING–retaining			
25	1	PIN			
26	1	TROLL BRACKET			
27	1	SPRING			
28	1	LEVER–control			
29	1	RING–retaining			
30	2	COVER–lower mount			
31	2	SCREW (M8x100)	390	32.5	44.1
32	1	SCREW (M8x60)	390	32.5	44.1
33	3	WASHER			
34	3	NUT	390	32.5	44.1
35	1	BUMPER–front			
36	2	MOUNT–lower			
37	1	SWIVEL HEAD			
38	2	SCREW–upper mount (M8x1.25x133)	220	18.0	24.9
39	2	MOUNT–upper			
40	2	WASHER–rubber - upper mount screw			
41	2	WASHER–upper mount screw			
42	2	NUT–upper mount screw	220	18.0	24.9
43	1	SCREW (.375-24x1.25)	240	20.0	27.1
44	1	STEERING LINK ASSEMBLY			
45	1	WASHER			
46	1	NUT			
	1	BRACKET–ride guide **(BLACK)**			
47	2	SCREW (M10x1.5x25)	390	32.5	44.1
48	2	LOCKWASHER			
49	1	WASHER			
50	1	NUT	240	20.0	27.1

Drive Shaft Housing Assembly



7 Loctite 271 (92-809820)

A=SERVICE ONLY

Drive Shaft Housing Assembly

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	SEAL–adaptor plate			
2	1	ADAPTOR PLATE ASSEMBLY			
3	1	GASKET–adaptor plate			
4	2	SCREW (M6x1x20)	80		9.0
5	2	BRACKET–upper mount			
6	1	EXHAUST TUBE (Part of Ref. #2)			
7	1	HOUSING ASSEMBLY–water tube			
8	1	SPACER–water tube			
9	1	SEAL–water tube			
10	2	SCREW (M5x.8x16)	35		4.0
11	1	WATER TUBE **(SHORT SHAFT)**			
	1	WATER TUBE **(LONG SHAFT)**			
12	1	HOUSING ASSEMBLY **(SHORT SHAFT)** **BLACK**			
	1	HOUSING ASSEMBLY **(LONG SHAFT)**			
	1	HOUSING ASSEMBLY **(SHORT SHAFT)** **GRAY**			
	1	HOUSING ASSEMBLY **(LONG SHAFT)**			
	1	HOUSING ASSEMBLY **(LONG) (TRACKER GRAPHITE GRAY)**			
13	1	GASKET–drive shaft housing			
14	1	GASKET–idle relief cover			
15	1	COVER–idle relief			
16	1	SCREW–cover (1/4-20x1-1/4 IN.)	Drive Tight		
17	6	SCREW–drive shaft housing to block (M8 x 70)		20	27.1
18	6	WASHER–drive shaft housing screw			
19	4	SCREW (M6x1x20)	85		9.6
20	1	TRIM COVER **(BLACK)**			
	1	TRIM COVER **(GRAY)**			
	1	TRIM COVER **(TRACKER GRAPHITE GRAY)**			

Drive Shaft Housing Disassembly/Reassembly

Servicing components such as steering arm, drive shaft housing, exhaust assembly and swivel bracket will usually require powerhead and/or gear housing removal.

Refer to SECTION 4 for powerhead removal and SECTION 6 for gear housing removal.

The transom bracket, lower mount bracket, tilt tube and lower engine mounts can be serviced without powerhead/gear housing removal. However, OUTBOARD MUST BE SUPPORTED BEFORE SERVICING COMPONENTS.

IMPORTANT: All gaskets should be replaced when removing powerhead and/or disassembling drive shaft housing. Corresponding gasket mating surfaces should be cleaned of any gasket material before installing new gaskets.

LOWER UNIT

Section 6A – Gear Housing

Table of Contents

6
A

Specifications

GEAR HOUSING BIGFOOT (2.42:1)	**Gear Ratio**	2.42:1
	Gearcase Capacity	7.8 fl oz (230 mL)
	Lubricant Type	Quicksilver Gear Lube-Premium Blend
	Forward Gear	
	Number of Teeth	29 Spiral/Bevel
	Pinion Gear	
	Number of Teeth	12 Spiral/Bevel
	Pinion Height	No Adjustment
	Forward Gear Backlash	No Adjustment
	Water Pressure (With Thermostat)	
	@ 950 rpm (Idle)	1 - 4 psi (7-28 kPa)
	@ 5000 rpm (WOT)	6 - 9 psi (41-62 kPa)

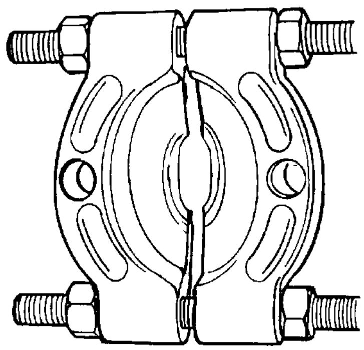
NOTE: *Before filling gear case, apply 10-12 psi of air pressure at the vent hole. Pressure should not drop for 5 minutes while alternately applying a 2-3 pound force to the top of the shift shaft in the fore and aft direction.*

Quicksilver Lubricants and Service Aids

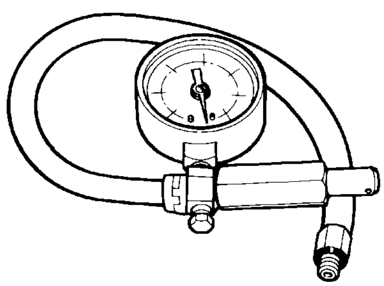
Part No.	Description
92-809819	Loctite "271"
92-850736A1	2-4-C w/Teflon
92-809824	Loctite Primer "7649"
92-850737A1	Super Duty Gear Lubricant

Special Tools

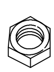
1. Universal Puller Plate 91-37241



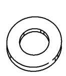
2. Leakage Tester FT8950



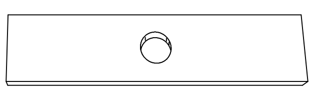
3. Bearing Puller & Installation Tool 91-31229A7
   a. Nut 11-24156



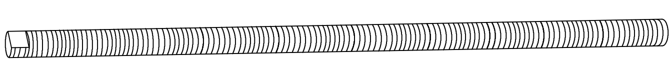
   b. Washer (2) 12-34961



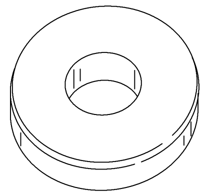
   c. Plate 91-29310



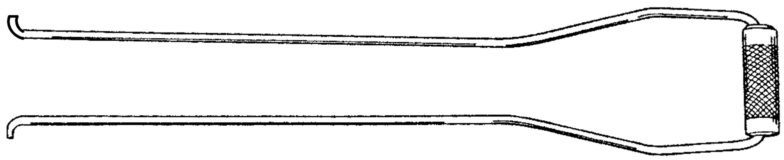
   d. Threaded Rod 91-31229



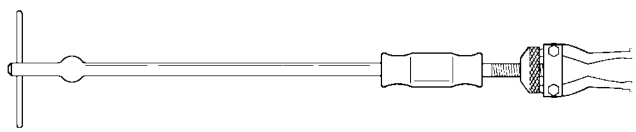
e. Mandrel 91-36571



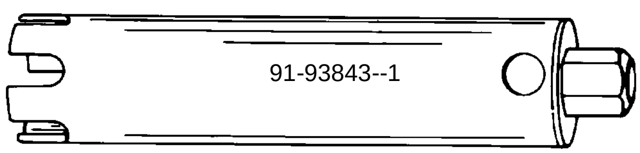
4. Bearing Puller Tool 91-27780



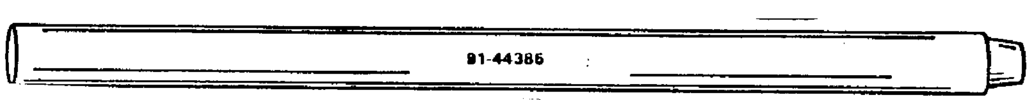
5. Slide Hammer 91-34569A1



6. Bearing Carrier Tool 91-93843--1



7. Bearing Cup Puller 91-44385



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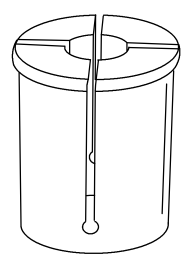
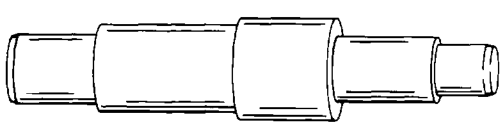
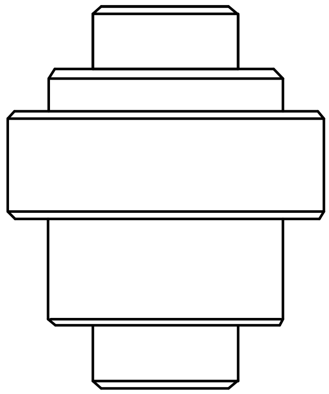


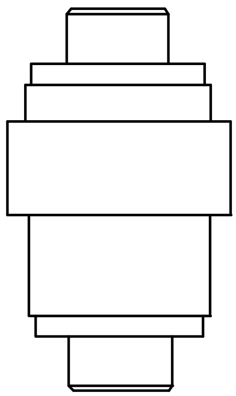
8. Bushing Removal Tool 91-824787



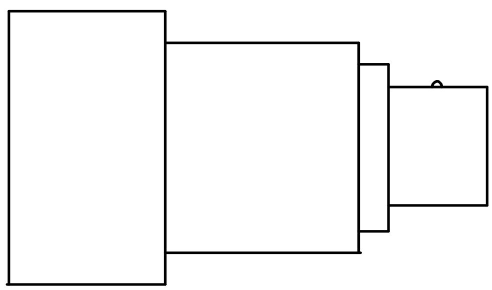
9. Driveshaft Seal Installation Tool 91-858775



10. Bearing Carrier Prop Shaft Seal Installation Tool 91-858776

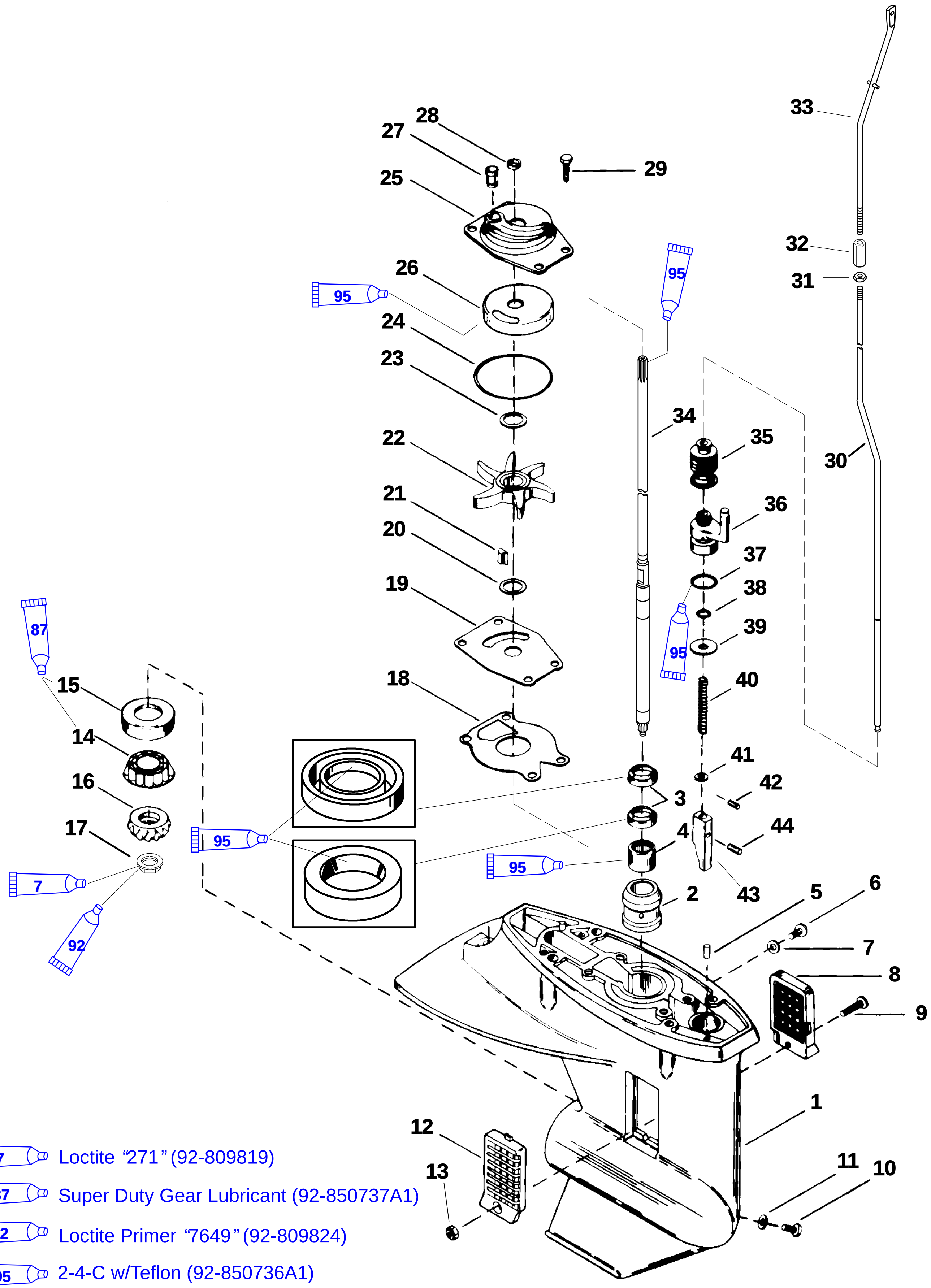


11. Bearing Carrier Prop Shaft Bearing Installation Tool 91-858777



Notes:

Gear Housing (Drive Shaft)



7 Loctite "271" (92-809819)

87 Super Duty Gear Lubricant (92-850737A1)

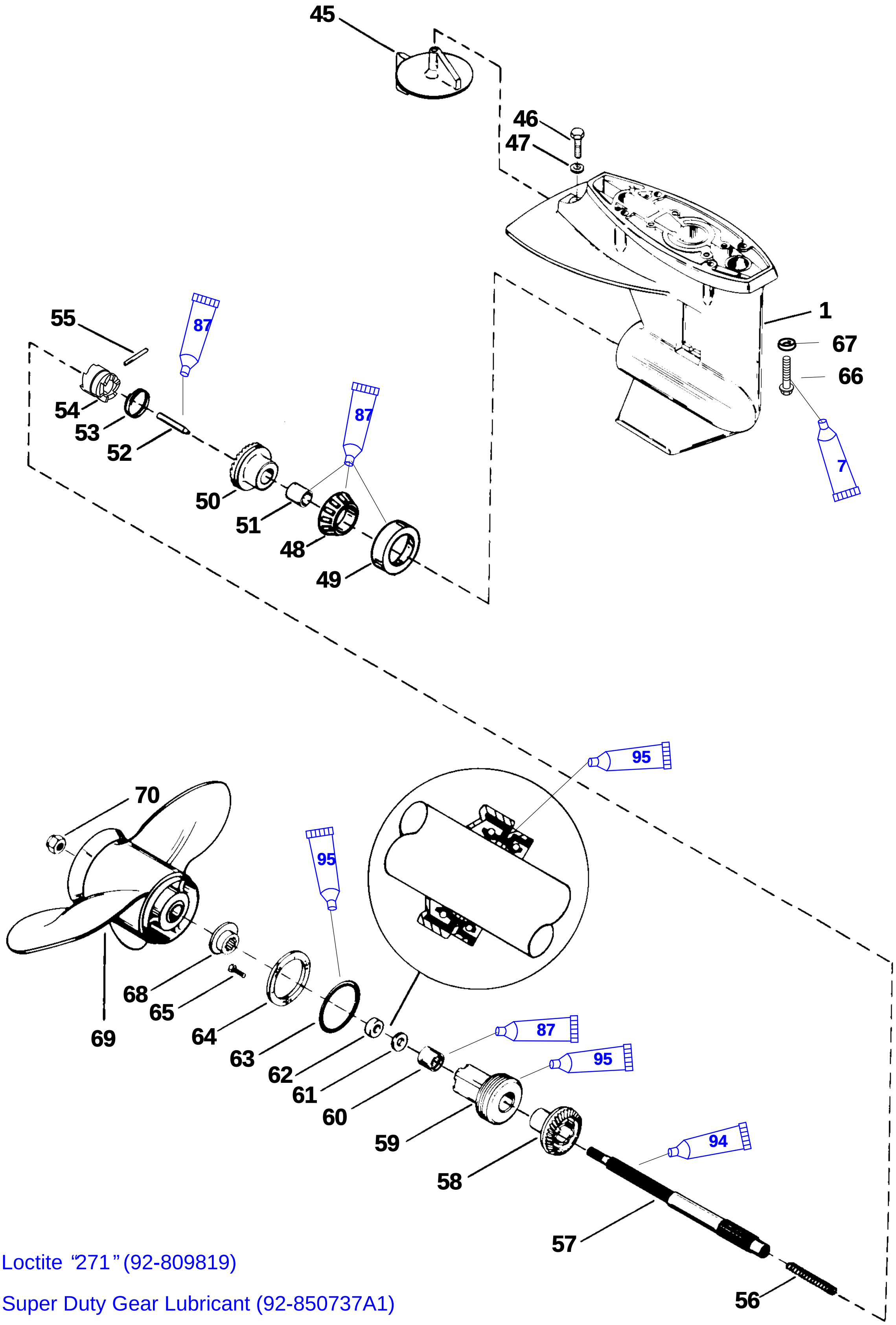
92 Loctite Primer "7649" (92-809824)

95 2-4-C w/Teflon (92-850736A1)

Gear Housing (Drive Shaft)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb-in.	TORQUE lb-ft	TORQUE Nm
1	1	GEAR HOUSING ASSEMBLY			
2	1	SLEEVE			
3	2	SEAL–gear housing			
4	1	ROLLER BEARING–upper			
5	2	DOWEL PIN (.187 x .53)			
6	1	SCREW (.375 x.25)	60		6.8
7	1	WASHER–sealing			
8	1	SCREEN–water inlet-port			
9	1	SCREW (M5 x 40)	25		2.8
10	1	DRAIN SCREW–magnetic	60		6.8
11	1	WASHER			
12	1	SCREEN–starboard			
13	1	NUT (M5)			
14	1	ROLLER BEARING ASSEMBLY			
15	1	CUP			
16	1	PINION GEAR (12-29)			
17	1	NUT		15	20.3
18	1	GASKET			
19	1	FACE PLATE			
20	1	WASHER			
21	1	KEY			
22	1	IMPELLER			
23	1	WASHER			
24	1	O-RING			
25	1	WATER PUMP ASSEMBLY			
26	1	INSERT			
27	1	SEAL			
28	1	RING			
29	4	BOLT (M6 x 16)	60		6.8
30	1	SHIFT SHAFT			
31	1	NUT (M6)	Tighten Securely		
32	1	COUPLER	Tighten Securely		
33	1	SHIFT SHAFT (UPPER)			
34	1	DRIVE SHAFT			
35	1	BOOT			
36	1	RETAINER			
37	1	O-RING			
38	1	O-RING			
39	1	WASHER			
40	1	SPRING			
41	1	WASHER			
42	1	ROLL PIN			
43	1	SHIFT CAM			
44	1	DRIVE PIN			

Gear Housing (Propeller Shaft)



7 Loctite "271" (92-809819)

87 Super Duty Gear Lubricant (92-850737A1)

94 Anti-Corrosion Grease (92-850735A1)

95 2-4-C w/Teflon (92-850736A1)

Gear Housing (Propeller Shaft)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in.	lb-ft	Nm
1	1	GEAR HOUSING ASSEMBLY			
45	1	TRIM TAB			
46	1	BOLT (M8x30)		17.1	23.2
47	1	WASHER			
48	1	TAPERED ROLLER BEARING			
49	1	CUP			
50	1	FORWARD GEAR (12-29)			
51	1	BUSHING			
52	1	CAM FOLLOWER			
53	1	SPRING			
54	1	CLUTCH			
55	1	CROSS PIN			
56	1	SPRING			
57	1	PROPELLER SHAFT			
58	1	REVERSE GEAR (12-29)			
59	1	BEARING CARRIER ASSEMBLY		80.0	108.5
60	1	ROLLER BEARING			
61	1	OIL SEAL (INNER)			
62	1	OIL SEAL (OUTER)			
63	1	O-RING			
64	1	PLATE			
65	3	BOLT (M5x16)	65		7.2
66	4	BOLT (M10 x 35)		40	54.2
67	4	WASHER			
68	1	THRUST HUB ASSEMBLY			
69	1	PROPELLER			
70	1	PROP NUT		16.7	22.6

General Service Recommendations

There may be more than one way to "disassemble" or "reassemble" a particular part(s), therefore, it is recommended that the entire procedure be read prior to repair.

IMPORTANT: Read the following before attempting any repairs.

In many cases, disassembly of a sub-assembly may not be necessary until cleaning and inspection reveals that disassembly is required for replacement of one or more components.

Service procedure order in this section is a normal disassembly-reassembly sequence.

Threaded parts are right hand (RH), unless otherwise indicated.

When holding, pressing or driving is required, use soft metal vise jaw protectors or wood for protection of parts. Use a suitable mandrel (one that will contact only the bearing race) when pressing or driving bearings.

Whenever compressed air is used to dry a part, verify that no water is present in air line.

BEARINGS

All bearings must be cleaned and inspected. Clean bearings with solvent and dry with compressed air. Air should be directed at the bearing so that it passes through the bearing. DO NOT spin bearing with compressed air as this may cause bearing to score from lack of lubrication. After cleaning, lubricate bearings with Quicksilver Gear Lubricant. DO NOT lubricate tapered bearing cups until after inspection.

Inspect all bearings for roughness, catches and bearing race side wear. Work inner bearing race in-and-out, while holding outer race, to check for side wear. When inspecting tapered bearings, determine condition of rollers and inner bearing race by inspecting bearing cup for pitting, scoring, grooves, uneven wear, imbedded particles and/or discoloration from over-heating. Always replace tapered bearing and race as a set.

Inspect gear housing for bearing races that have spun in their respective bores. If race(s) have spun, gear housing must be replaced.

Roller bearing condition is determined by inspecting the surface of the shaft that the roller bearing supports. Check shaft surface for pitting scoring, grooving, imbedded particles, uneven wear and/or discoloration from overheating. The shaft and bearing must be replaced if such a condition exists.

SEALS

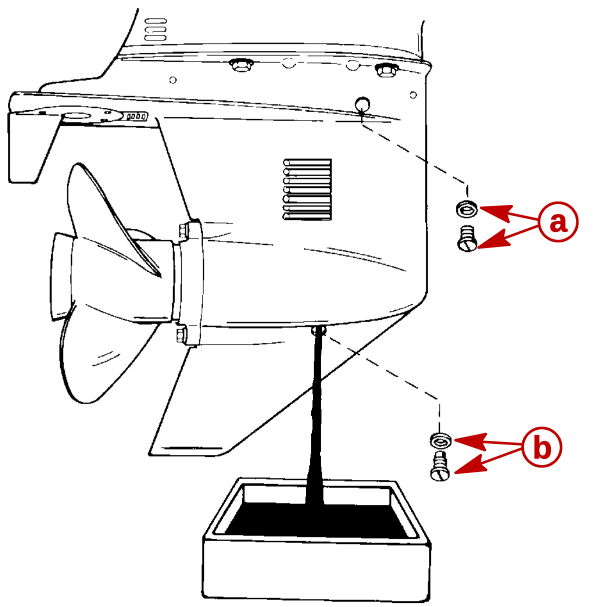
As a normal procedure, all O-rings and oil seals SHOULD BE REPLACED without regard to appearance. To prevent leakage around seals, apply Loctite 271 to outer diameter of all metal case seals. When using Loctite on seals or threads, surfaces must be clean and dry. Apply 2-4-C w/Teflon on all O-rings and on I.D. of oil seals. Apply 2-4-C w/Teflon to bearing carrier threads and pilot diameters.

Draining and Inspecting Gear Lubricant

⚠ WARNING

If gear housing is installed on outboard, disconnect (and isolate) spark plug leads from spark plugs before working near the propeller.

1. With gear housing in normal running position, place a clean pan under housing and remove vent plug and fill/drain plug (with gaskets).



a-Vent Plug/Washer
b-Drain Plug/Washer

2. Inspect gear lubricant for metal particles (lubricant will have a "metal flake" appearance). Presence of fine metal particles (resembling powder) on the drain plug magnet indicates normal wear. Metal chips on the magnet indicate the need for gear housing disassembly and component inspection.
3. Note color of gear lubricant. White or cream color indicates presence of water.
4. Presence of water indicates the need for disassembly and inspection of oil seals, O-rings, gaskets and components for damage. Pressure check prior to disassembly to determine leak area.

Gear Housing Removal

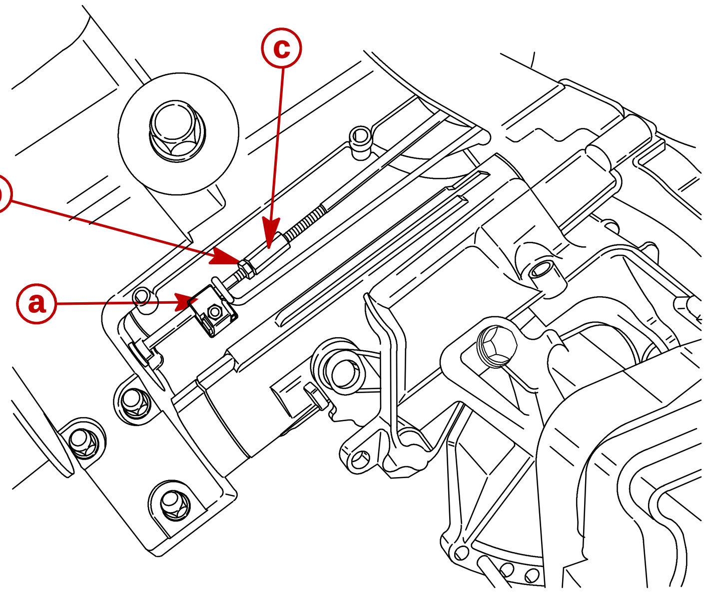
⚠ WARNING

To prevent accidental engine starting, remove (and isolate) spark plug leads from spark plugs BEFORE removing gear housing.

1. Tilt outboard to full "UP" position.

9.9/15 Bigfoot (4 Stroke)

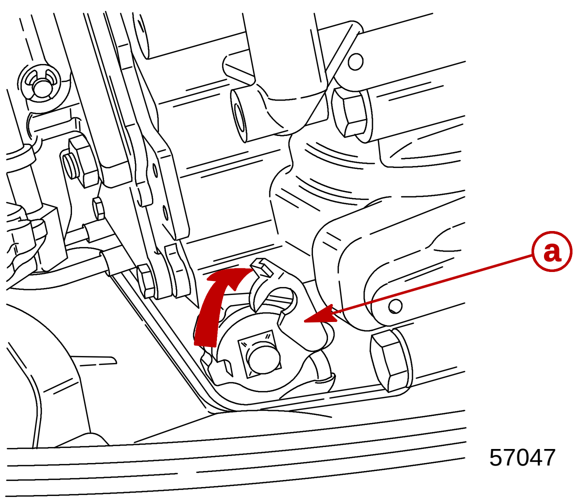
2. Remove reverse hook guide assembly from lower shift shaft.
3. Loosen jam nut and disconnect coupler. Remove jam nut to allow removal of gearcase.



a-Reverse Hook Guide
b-Jam Nut
c-Coupler

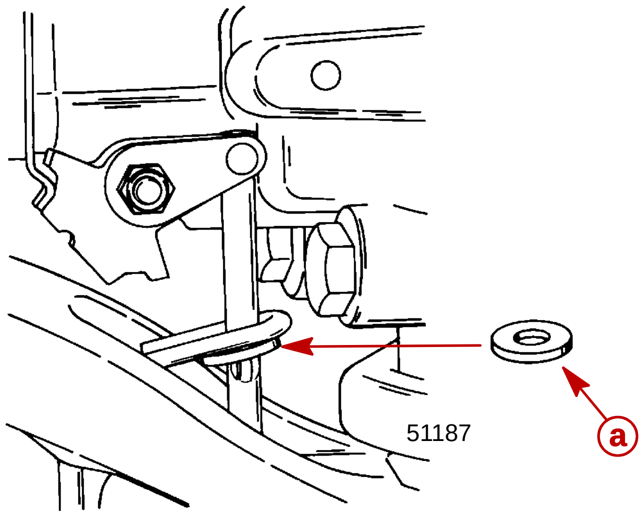
20/25 (2 Stroke)

4. Unlatch and remove retainer to free shift shaft for removal of gearcase.



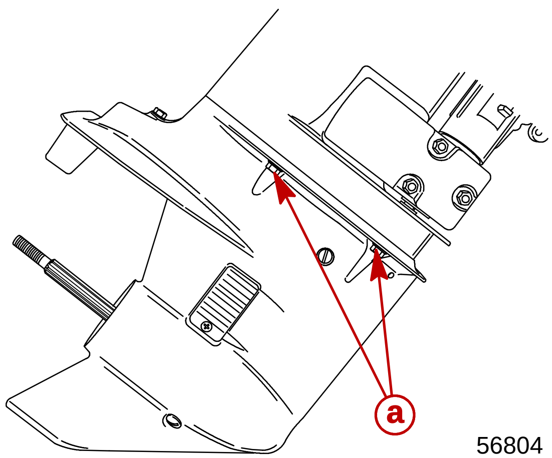
a-Retainer

NOTE: *A flat washer is located on the shift shaft near the top of the shaft. This washer may slide off shift shaft when gear case is removed. Do not lose washer as washer is necessary for reassembly.*



a-Flat Washer

5. Remove four screws and remove gear housing.



a-Screws (4)

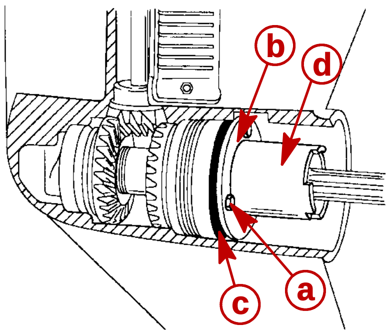
NOTE: *If water tube should pull out of driveshaft housing, remove tube from water pump and insert tube back into driveshaft housing to aid in reassembly.*

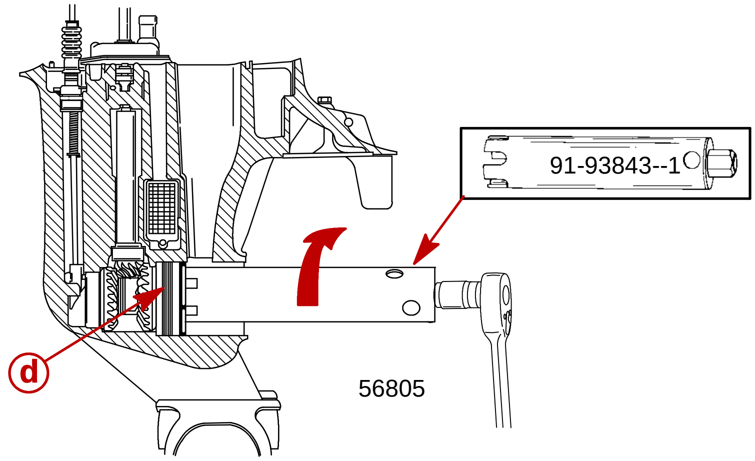
Disassembly

IMPORTANT: It is recommended that, during complete disassembly of gear housing, all O-rings and oil seals be replaced, regardless of their appearance.

Bearing Carrier

1. Remove 3 screws which secure the O-ring retainer plate and O-ring to the bearing carrier. Remove the O-ring retainer plate and O-ring from gear housing.
2. Remove bearing carrier using Special Tool 91-93843--1 (LEFT HAND THREAD).



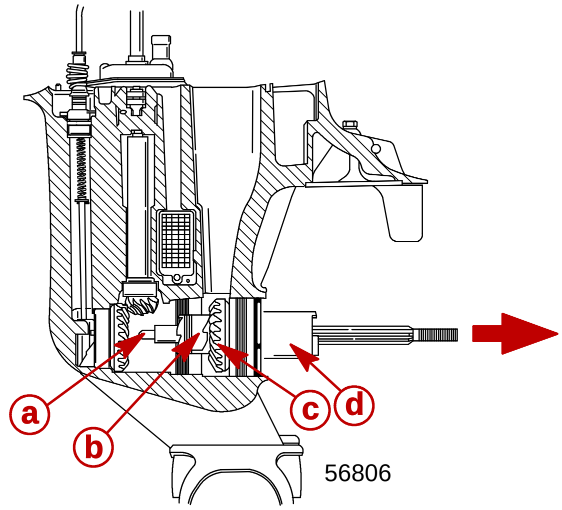


a-Screws (3)
b-O-Ring Retainer Plate
c-O-Ring
d-Bearing Carrier

3. While holding onto propeller shaft and bearing carrier, pull propeller shaft from propeller shaft cavity, as shown.

NOTE: *Cam follower is free to slide out of propeller shaft.*

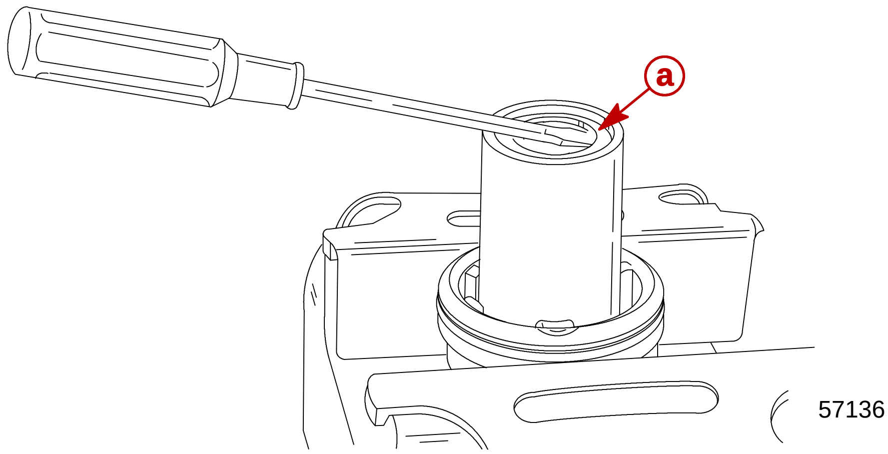
4. Remove reverse gear and bearing carrier from propeller shaft.
5. Separate reverse gear from bearing carrier.



a-Cam Follower
b-Propeller Shaft Assembly
c-Reverse Gear
d-Bearing Carrier

***NOTE:** When using a screwdriver to remove carrier seals, be careful not to scar carrier seal surface. If carrier seal surface is damaged, replace carrier.*

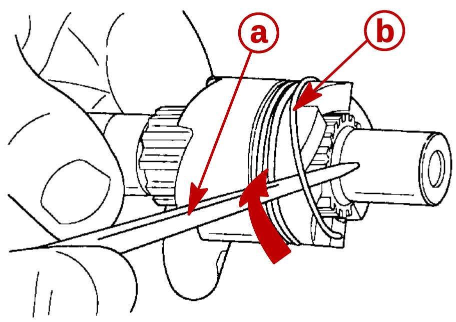
6. Secure bearing carrier in a vise. Using a screwdriver, pry out both seals from bearing carrier.



a-Oil Seals

Propeller Shaft

1. Insert a thin blade screwdriver or awl under first coil (from front) of cross-pin retainer spring.
2. Rotate propeller shaft to unwind spring from sliding clutch.



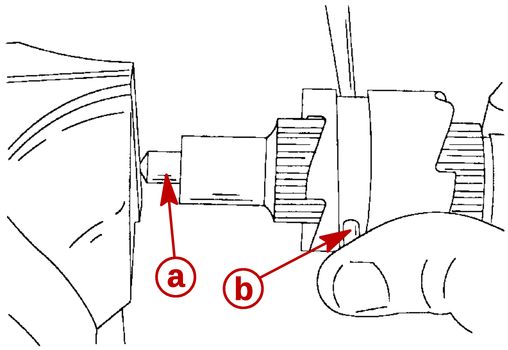
a-Awl
b-Cross Pin Retaining Ring

3. Insert flat end of cam follower into front end of propeller shaft.
4. Position cam follower against a solid surface.

⚠ WARNING

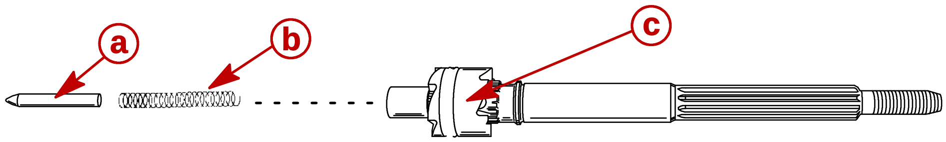
Use caution when removing cam follower. As the cross-pin is remove the cam follower can shoot out of the propeller shaft as a high speed projectile.

5. Push against cam follower. Use a punch or awl to push cross-pin out of sliding clutch.
6. Release pressure against cam follower.



a-Cam Follower
b-Cross Pin

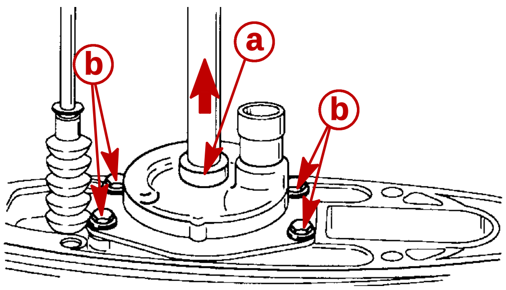
7. Remove cam follower, spring and sliding clutch from propeller shaft.



a-Cam Follower
b-Spring
c-Clutch

Water Pump

1. Slide centrifugal slinger off drive shaft.
2. Remove four (4) screws securing water pump to gear housing as shown in illustration.

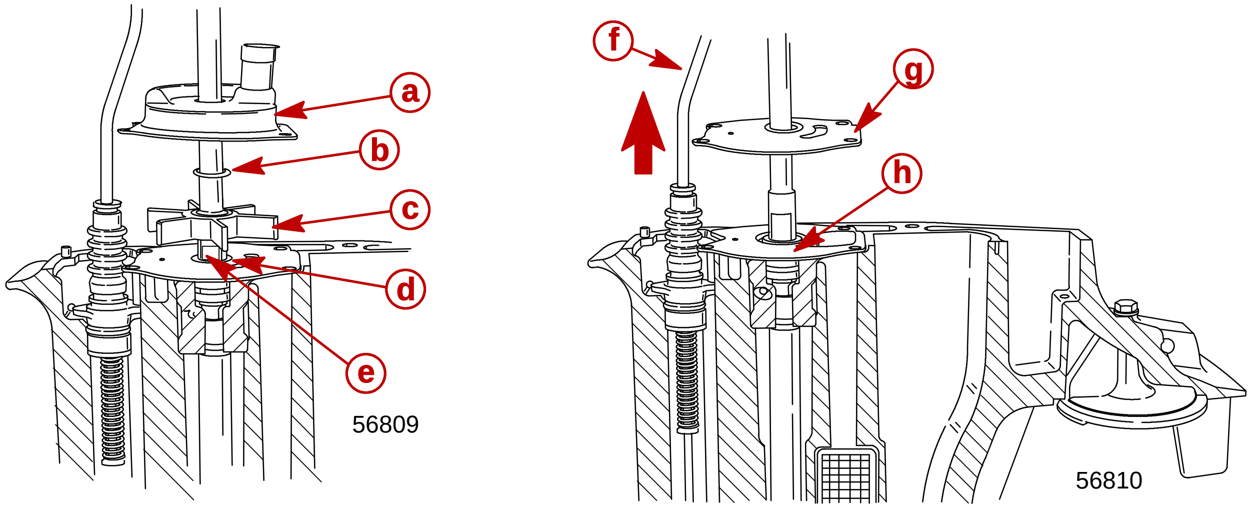


a-Centrifugal Slinger
b-Water Pump Mounting Screws

3. Remove cover, nylon washers (above and below impeller), impeller and drive key from drive shaft.
4. It is recommended that impeller be replaced whenever gear case is being serviced.

NOTE: *If impeller is not going to be replaced, DO NOT install impeller in reverse rotation to its original state as vanes have taken a set. Vanes will crack and break shortly after outboard is returned to service.*

5. Remove face plate and base gasket.
6. Remove shift shaft from housing.



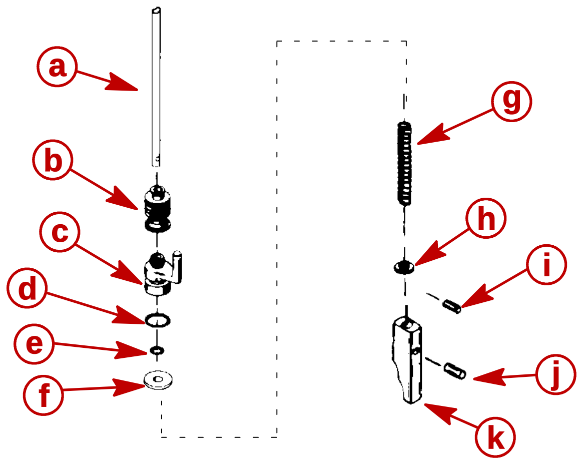
a-Cover
b-Nylon Washer
c-Impeller
d-Nylon Washer
e-Key
f-Shift Shaft
g-Face Plate
h-Base Gasket

NOTE: *Replace impeller if:*

- *Impeller blades are cracked, torn or worn.*
- *Impeller is glazed or melted.*
- *Rubber portion of impeller is not bonded to impeller hub.*

Shift Shaft

1. Pull shift shaft assembly from gear housing.
2. Remove and replace outer O-ring from shift shaft retainer.

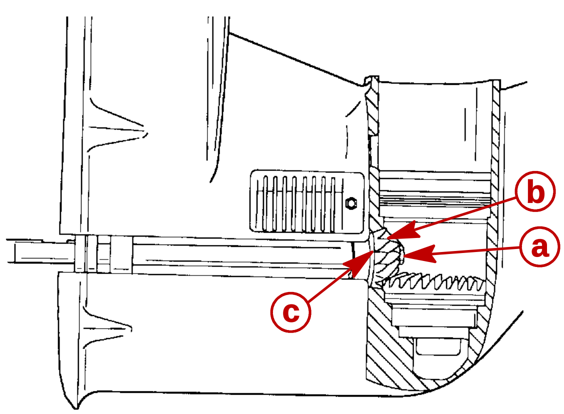


a-Shift Shaft
b-Boot
c-Retainer
d-O-ring (outer)
e-O-ring (inner)
f-Washer
g-Spring
h-Washer
i-Roll Pin
j-Driver Pin
k-Shift Cam

Drive Shaft and Pinion Gear

1. Clamp driveshaft in a soft jaw vise and remove pinion nut or bolt that secures pinion to driveshaft. Pull driveshaft out of gear housing. Remove pinion and tapered roller bearing.

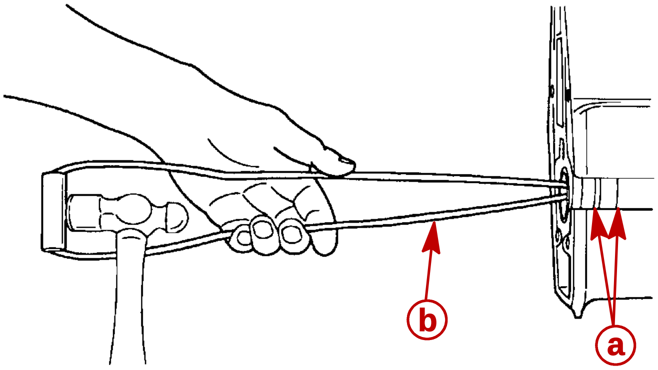
NOTE: *9.9/15 Bigfoot (4 Stroke) uses nut to secure pinion gear. 20/25 (2 Stroke) uses bolt to secure pinion gear.*

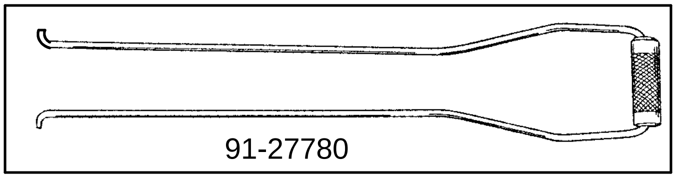


a-Pinion Nut/Bolt
b-Pinion
c-Tapered Roller Bearing

Upper Drive Shaft and Bearing/Seals

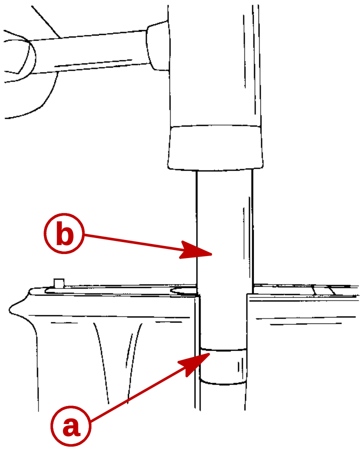
1. Using Water Pump Cartridge Puller (91-27780), as shown, remove the driveshaft oil seals from gear housing.





a-Oil Seals
b-Water Pump Cartridge Puller

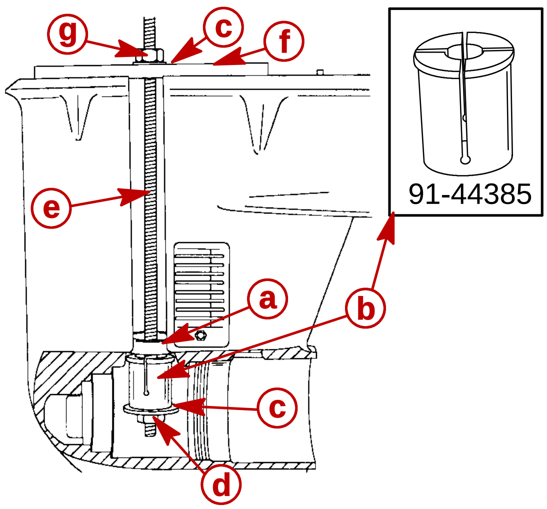
2. Using suitable mandrel drive upper drive shaft bearing through gearcase sleeve to the bottom of gearcase.
3. Do not remove gearcase sleeve (not shown).

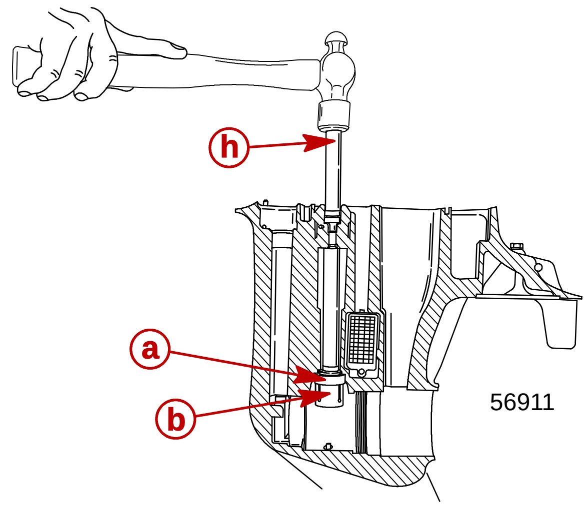


a-Upper Driveshaft Bearing
b-Mandrel

Lower Drive Shaft Bearing/Cup

1. Fasten bearing cup puller on a threaded rod as shown.
2. Tighten hex nut and draw the bearing cup puller up into bearing cup until lip on tool snaps over the top side of bearing cage. Remove threaded rod assembly.
3. Insert tapered end of rod (91-44385) into bearing cup puller and tap bearing cup out of driveshaft bore.

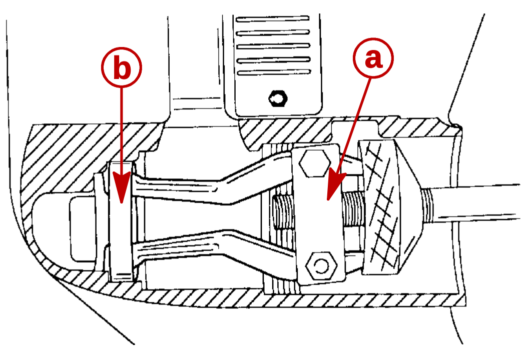


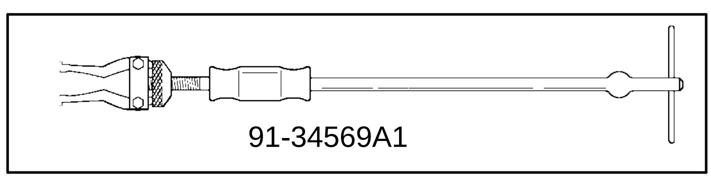


a-Bearing Cup
b-Bearing Cup Puller (91-44385)
c-Flat Washers 2 (12-34961)
d-Hex Nut 0.625x18 (11-24156)
e-Threaded Rod 0.625x18-16 Long (91-31229)
f-Plate (91-29310)
g-Hex Nut 0.625x18 (11-24156)
h-Tapered Rod (91-44385)

Forward Gear Race

1. Use slide hammer to remove forward gear tapered bearing race as shown.





a-Slide Hammer
b-Tapered Bearing Race

Cleaning and Inspection

Gear Housing/Bearing Carrier Castings

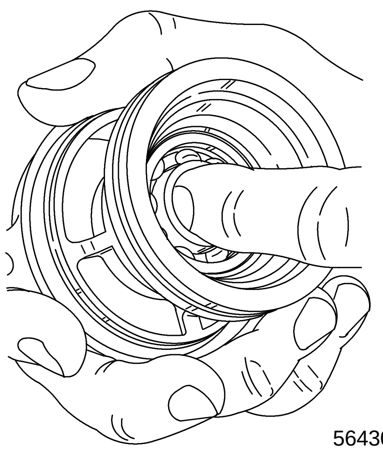
1. Thoroughly clean gear housing/bearing carrier castings. Be sure all old gasket material is removed from mating surfaces and that carbon deposits have been removed from exhaust passages.
2. Inspect castings for cracks or fractures.
3. Check sealing surfaces for nicks, deep grooves and distortion which could cause leaks.
4. Check water passages for obstructions.

Ball Bearings

⚠ CAUTION

DO NOT spin-dry ball bearings with compressed air.

1. Clean bearing in solvent and dry with compressed air.
2. Bearing should be free of rust stains.
3. Attempt to work inner bearing race in-and-out. There should not be excessive play.
4. Lubricate ball bearing with Quicksilver Gear Lube. Rotate inner bearing race. Bearing should have smooth action. If ball bearing sounds or feels rough or has catches, remove and discard bearing. Refer to "Bearing Carrier" following.



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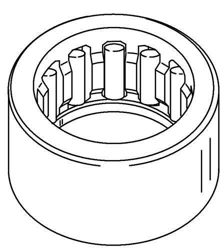
Needle Bearing

1. Clean needle bearings in solvent and dry with compressed air.
2. Replace bearing if needles are rusted, fractured, worn, galled badly, discolored, or if area of shaft that bearing contacts is worn or pitted. Refer to "Drive Shaft" following.



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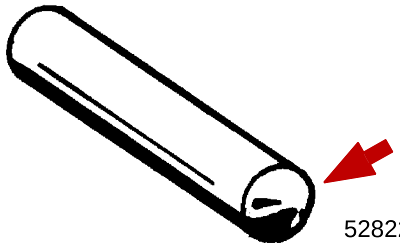
Cam Follower

1. Inspect cam follower for wear or galling. If wear is present, inspect corresponding shift cam for wear. Replace if worn.



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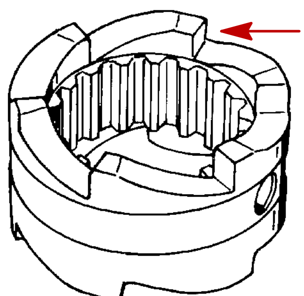
Clutch

1. Replace clutch if jaws are rounded or chipped. Rounded jaws may be caused by the following:
   - Improper shift cable adjustment or linkage.
   - Engine idle speed too high while shifting.
   - Shifting too slowly from NEUTRAL into FORWARD or REVERSE.



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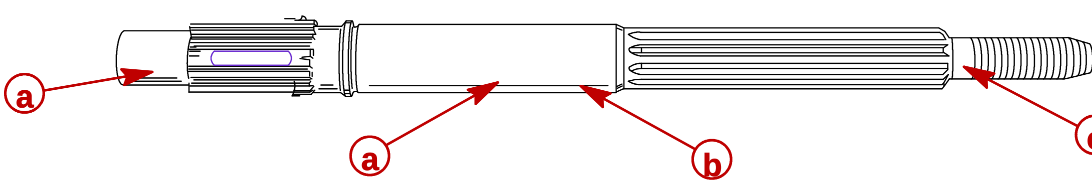
Propeller shaft

1. Check propeller shaft for straightness.
2. Inspect bushing/bearing surfaces of propeller shaft for pitting or wear. Replace shaft and corresponding bushing/bearing if wear or pitting is observed.
3. Replace propeller shaft if any of the following exist:
   - Splines are twisted or worn.
   - Oil seal surface is grooved.
   - Shaft has a noticeable "wobble" or is bent more than 0.006 in. (0.15 mm).



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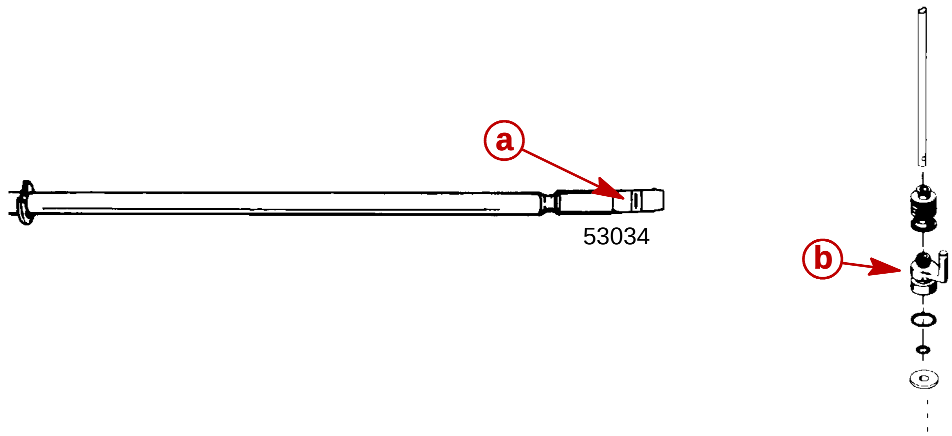
a-Bushing/Bearing Surfaces
b-Oil Seal Surface
c-Measure Here for "Wobble" (When measuring shaft for wobble, use v-blocks and support at bushing surface)

Shift Shaft

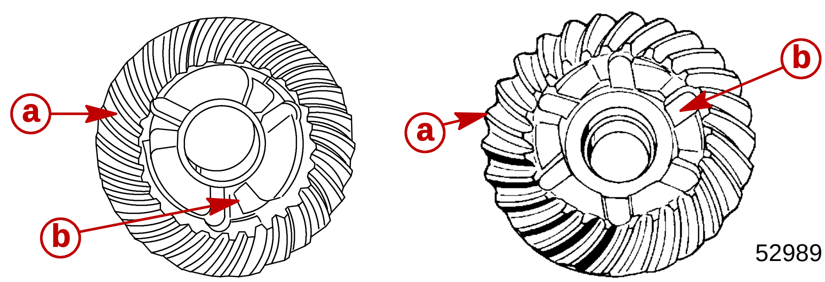
1. Inspect shift shaft retainer for cracks and replace if necessary.
2. Inspect shift cam face for wear. Replace if worn.



a-Shift Cam
b-Shift Shaft Retainer

Reverse And Forward Gear

1. Inspect gear teeth for pitting, uneven wear, scoring, etc. Replace gear if any damage is found.
2. Inspect gear clutch jaws. Replace gear if jaws are rounded or chipped.



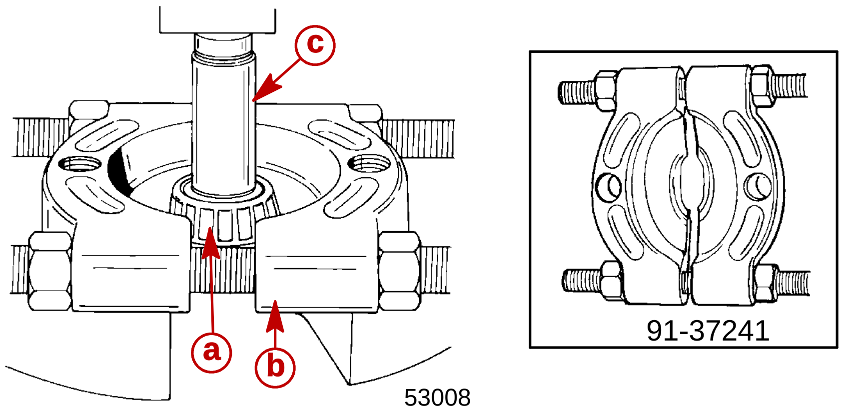
a-Gear Teeth
b-Clutch Teeth

3. Inspect FORWARD gear tapered bearing and race for rust, roughness, pitting, spalling or excessive wear (looseness).

NOTE: *DO NOT remove tapered bearing from FORWARD gear unless replacement is necessary as removal process will damage bearing.*

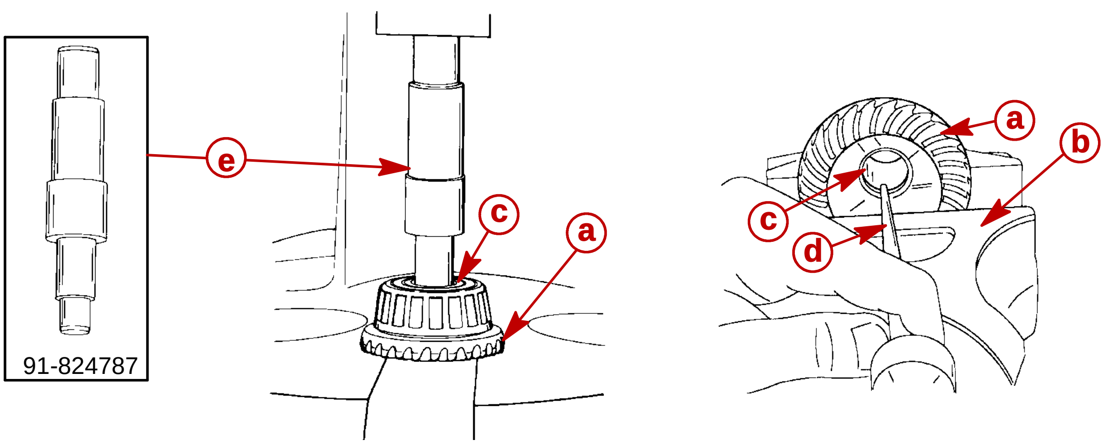
4. If bearing must be replaced, remove bearing from gear using Universal Puller Plate (91-37241) and a suitable mandrel (5/8 in. socket).

IMPORTANT: If FORWARD gear tapered bearing or race requires replacement, replace bearing and race as a set.



a-Bearing
b-Universal Puller Plate (91-37241)
c-Mandrel (5/8 in. Socket)

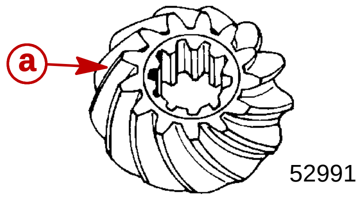
5. If inspection determines that replacement of forward gear bushing is required, remove bushing from forward gear using one of two ways.
6. **Using a Punch:** Secure forward gear in a vise. Be sure to use a soft jaw vise and do not clamp onto tapered bearing. Use a punch and hammer, remove bushing from the clutch jaw (teeth) side of gear.
7. **Using a Press:** Press bushing from gear using Bushing Removal Tool 91-824787.



a-Forward Gear
b-Vise Protector
c-Bushing
d-Punch
e-Bushing Removal Tool (91-824787)

Pinion Gear

1. Inspect pinion gear teeth for breakage, rust, chipping or excessive wear.
2. If pinion gear teeth are damaged, inspect FORWARD and REVERSE gear for damage.
3. Replace gears as required.

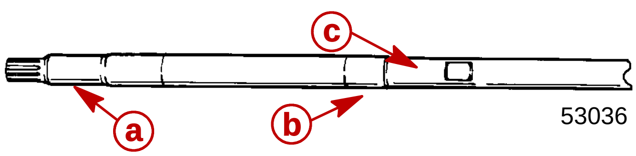


a-Pinion Gear

Driveshaft

IMPORTANT: If upper drive shaft bushing or lower drive shaft needle bearing race appear to be spinning in their respective bores, the gear housing should be replaced.

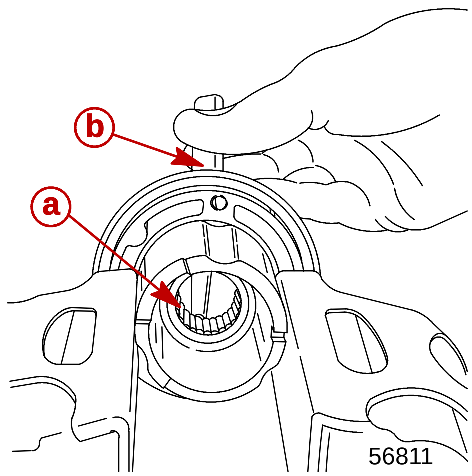
1. Replace drive shaft if the following exist:
   - Splines are twisted or worn.
   - Oil seal surface is grooved.
   - Bearing/Bushing journal surfaces are pitted or worn. Replace corresponding bearing as well.



a-Bearing/Bushing Surface
b-Bearing/Bushing Surface
c-Seal Surface

Bearing Carrier

1. If inspection of bearing area on propeller shaft determines that replacement of bearing inside of bearing carrier is required, remove bearing from bearing carrier.
2. Secure bearing carrier in a vise, DO NOT clamp onto threaded portion of bearing carrier.
3. Remove bearing from bearing carrier with a punch or suitable mandrel/socket and hammer.

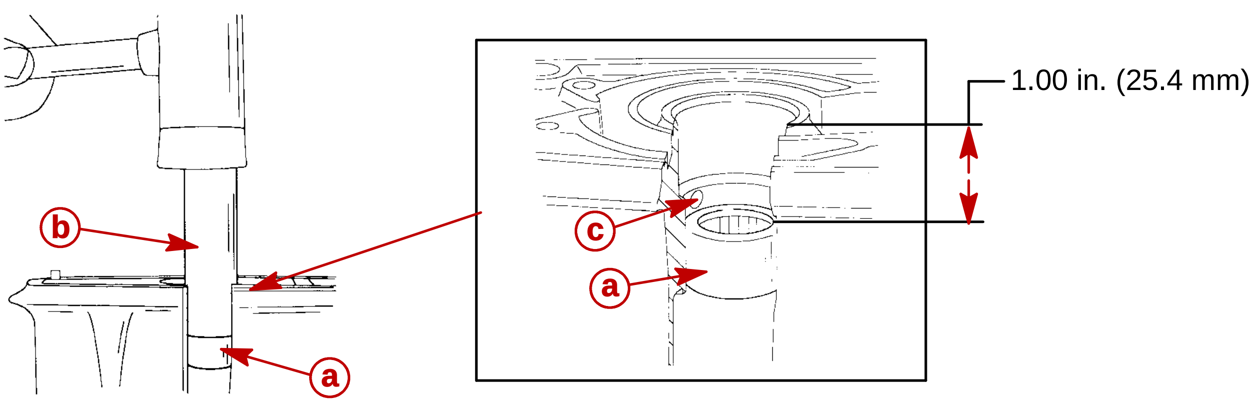


a-Bearing
b-Punch

Reassembly

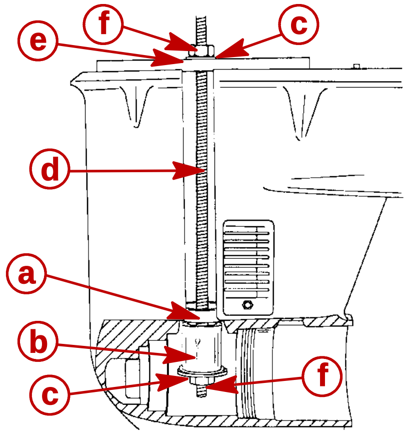
Drive Shaft Bearing and Seals

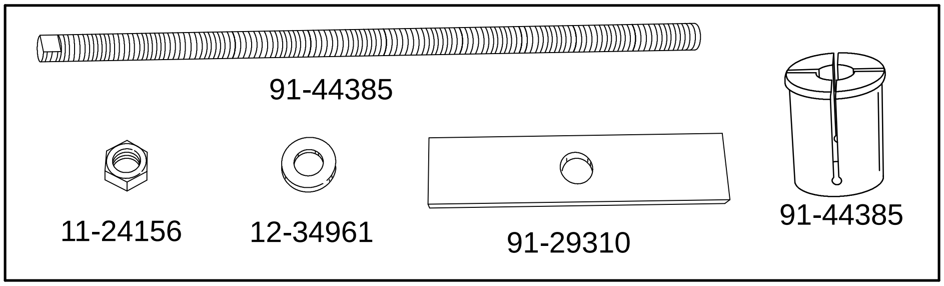
1. Install upper driveshaft bearing into driveshaft bore of gear housing sleeve. Apply a light coat of 2-4-C w/Teflon to upper driveshaft bearing retainer bore as follows:
   - Place upper driveshaft bearing over bearing retainer bearing bore with lettered side of bearing face up.
   - Using a suitable mandrel, press bearing into gear housing sleeve until the bearing is just below the oil hole to a depth of 1.00 in. (25.4 mm) as shown.



a-Upper Driveshaft Bearing
b-Mandrel
c-Oil Hole

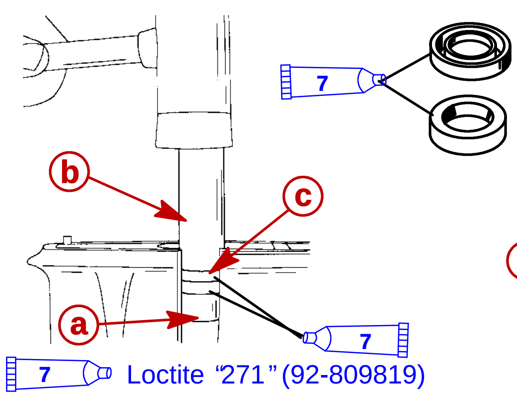
2. Install lower driveshaft bearing cup into driveshaft bore of gear housing as follows:
   - Assemble bearing cup as shown.
   - Draw bearing cup up to shoulder of gearcase housing using cup puller (91-44385) as shown

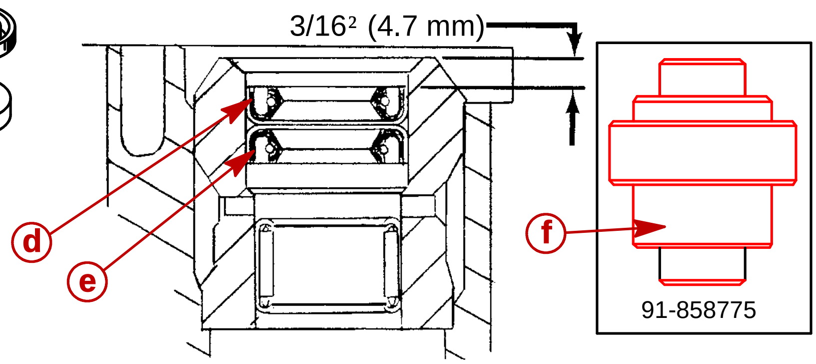




a-Bearing Cup
b-Bearing Cup Puller (91-44385)
c-Flat Washers 2 (12-34961)
d-Threaded Rod 0.625x18-16 in. long (91-31229)
e-Plate (91-29310)
f-Hex Nut 0.625x18 (2) (11-24156)

3. Install new driveshaft oil seals into driveshaft bore of gear housing as follows:
   - Apply Loctite “271” to outer diameter of driveshaft oil seals.
   - With lip of seal facing down, press the first oil seal into driveshaft bore until seal is just below the top of driveshaft bore.
   - With lip of seal facing up, and using Installation tool 91-858775, press the second oil seal into driveshaft bore until seal is 3/16" (4.7 mm) below top of driveshaft bore.
   - Wipe off excess Loctite.

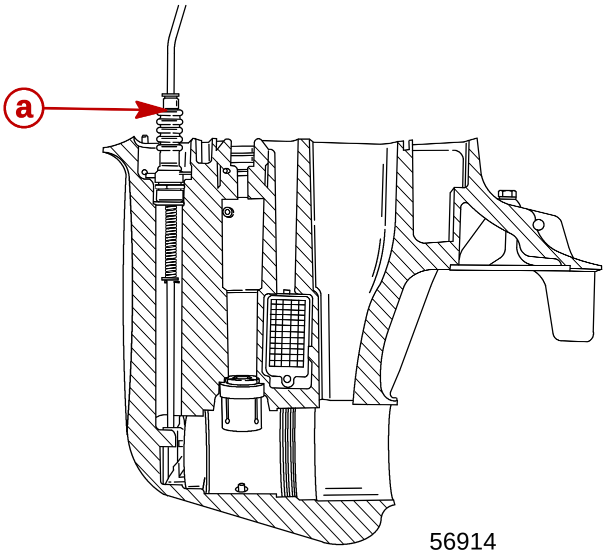




a-Upper Driveshaft Bearing
b-Mandrel
c-Seals (2)
d-Oil Seal with Lip of Seal Facing Up
e-Oil Seal with Lip of Seal Facing Down
f-Installation Tool (91-858775)

Shift Shaft

1. Install shift shaft assembly into gear housing assembly.



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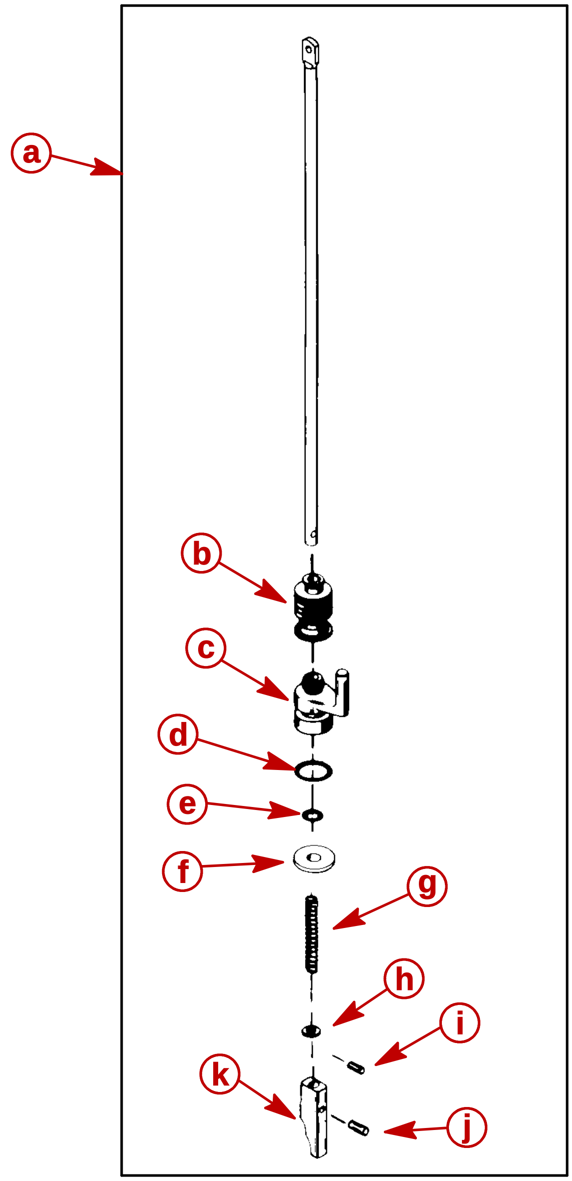
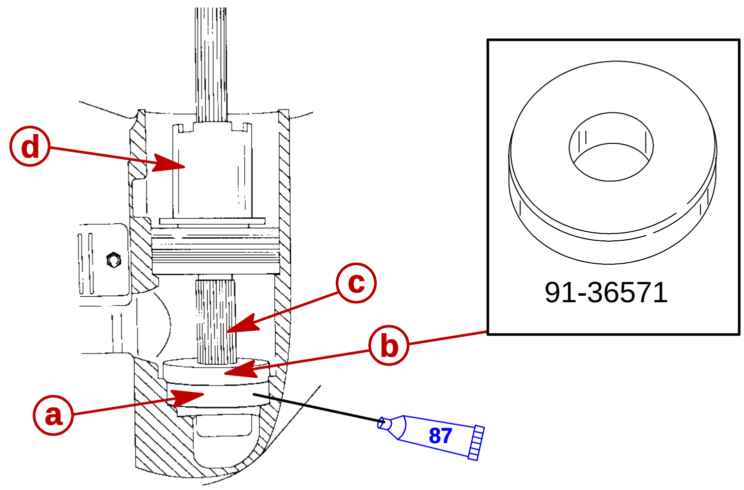


a-Shift Shaft Assembly
b-Boot
c-Retainer
d-O-ring (outer)
e-O-ring (inner)
f-Washer
g-Spring
h-Washer
i-Roll Pin
j-Driver Pin
k-Shift Cam

Forward Gear Installation

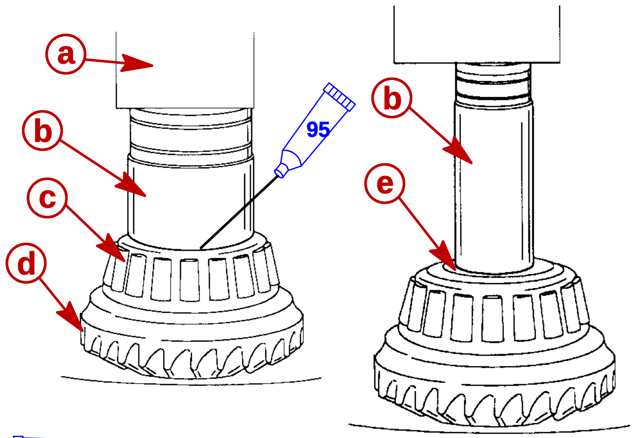
1. Install forward gear bearing race into gear housing.
2. Apply a light coat of Super Duty Gear Lubricant to forward gear bearing race bore in propeller shaft cavity.
3. Position tapered bearing race squarely over bearing bore in front portion of propeller shaft cavity.
4. Place mandrel (91-36571) from Bearing Installation Kit (91-31229A7) over tapered bearing race.
5. Place propeller shaft into hole in center of mandrel.
6. Install bearing carrier assembly over propeller shaft and thread it in 4 or 5 turns.
7. Thread a suitable nut onto propeller shaft to protect propeller shaft threads. (DO NOT use propeller nut.)
8. Use a mallet to drive propeller shaft against mandrel until tapered bearing race is firmly seated in bearing race bore.



87 Super Duty Gear Lubricant (92-850737A1)

a-Forward Gear Bearing Race
b-Mandrel (91-36571)
c-Propeller Shaft
d-Bearing Carrier

9. Remove nut from propeller shaft, then remove bearing carrier, propeller shaft and mandrel from propeller shaft cavity.
10. Apply a light coat of oil on tapered bearing race.
11. Place forward gear on a press with gear teeth down.
12. Apply a light coat of oil to I.D. of forward gear tapered bearing.
13. Position forward gear tapered bearing over gear.
14. Press on inner race of bearing until bearing is firmly seated against forward gear.
15. Apply a light coat of Gear Lube to bore in center of forward gear.
16. Using a suitable mandrel, press forward gear bushing into forward gear until bushing is flush with the back of gear.



95 2-4-C w/Teflon (92-850736A1)

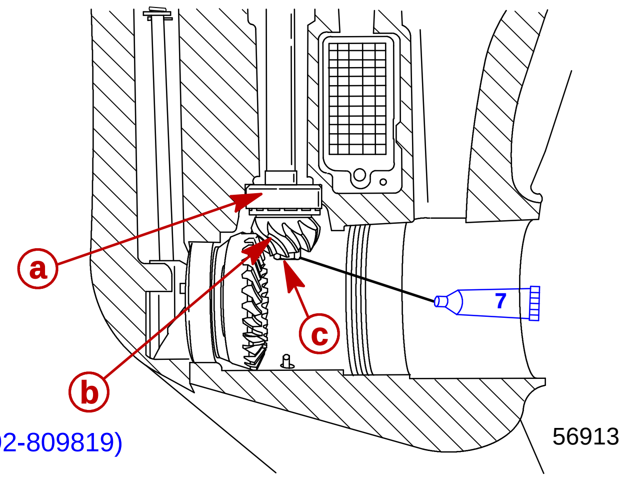
a-Press
b-Mandrel
c-Bearing
d-Forward Gear
e-Bushing

17. Apply a light coat of oil on forward gear tapered bearing, then position forward gear assembly in gear housing.

Pinion and Driveshaft

1. Place lower drive shaft tapered roller bearing into bearing cup.
2. Place pinion gear into gear housing with teeth of pinion meshed with teeth of forward gear.
3. Insert driveshaft into gear housing while holding pinion in place with other hand. Rotate driveshaft back and forth to align splines on driveshaft with splines in pinion gear.
4. Secure pinion gear to driveshaft. Apply Loctite "271" to pinion nut or bolt. Refer to table for "Fastener Type" and "Torque".

Model	Fastener Type	Torque
9.9/15 Bigfoot (4-Stroke)	Pinion Nut	15 lb-ft (20.3 Nm)
20/25 (2-Stroke)	Pinion Bolt	13.3 lb-ft (18.0 Nm)

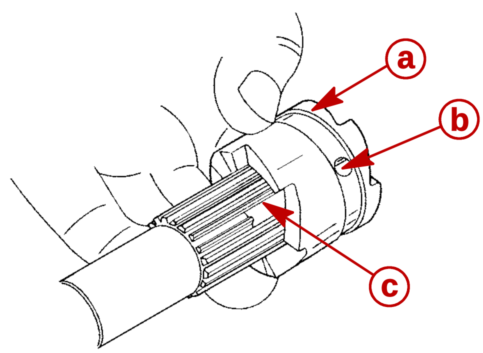


7 Loctite "271" (92-809819)

a-Tapered Roller Bearing
b-Pinion Gear
c-Fastener

Propeller Shaft

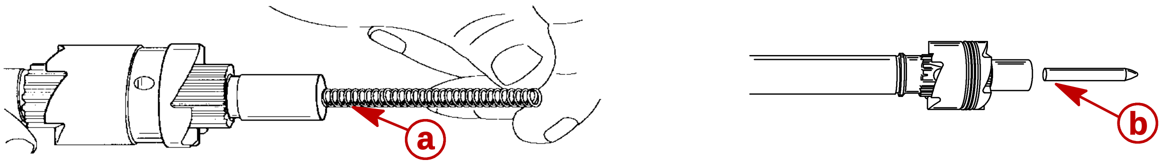
1. Position sliding clutch over propeller shaft spline with cross-pin holes aligned with slots in propeller shaft.



a-Short End
b-Cross Pin Hole
c-Slot

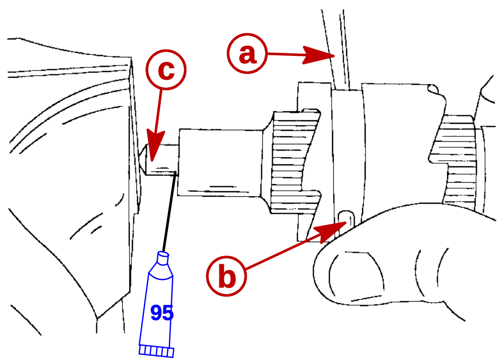
2. Apply a small amount of light oil onto sliding clutch spring and insert spring into propeller shaft.

3. Insert flat end of cam follower into propeller shaft.



a-Spring
b-Flat End of Cam Follower

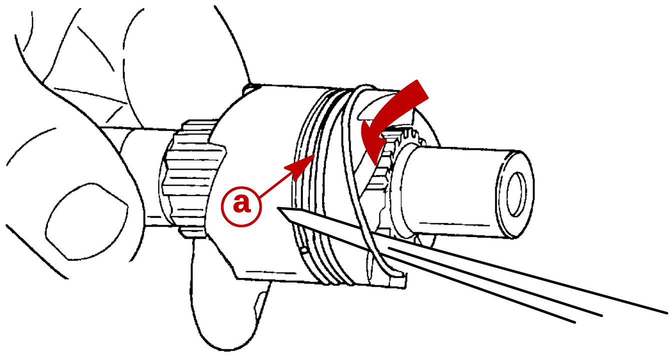
4. Place cam follower against a solid object and push against cam follower to compress spring.
5. Insert a punch thru the cross-pin holes in sliding clutch (between cam follower and spring).
6. Apply a light coat of oil on cross-pin and install cross-pin into sliding clutch by pushing punch out of clutch with cross-pin, as shown. (Release pressure on cam follower and remove follower from propeller shaft.)



95 2-4-C w/Teflon (92-850736A1)

a-Punch
b-Cross Pin
c-Cam Follower

7. Install cross-pin retainer spring.

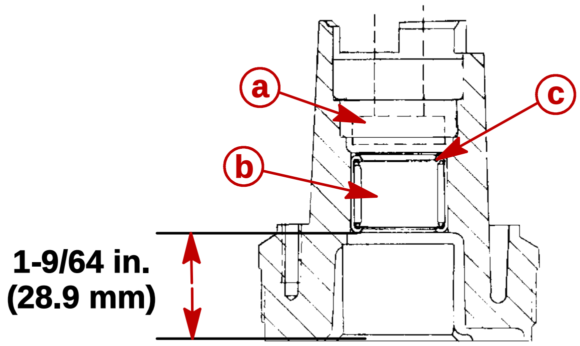


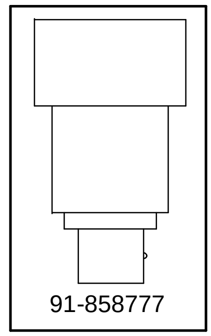
a-Cross Pin Retainer Spring

8. Place a dab of 2-4-C w/Teflon into end of propeller shaft and install cam follower (flat end first).

Bearing Carrier

1. Apply a small amount of oil into bearing bore in bearing carrier.
2. Position bearing carrier on a press (with the threaded side down).
3. Place propeller shaft bearing into aft end of bearing carrier with lettered end of bearing up.
4. Use installation tool (91-858777) to press bearing into bearing carrier until the installation tool bottoms out, or using a suitable mandrel press bearing to depth of 1-9/64 in. (28.9 mm) from end of bearing carrier housing.

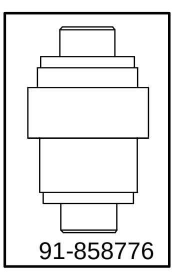


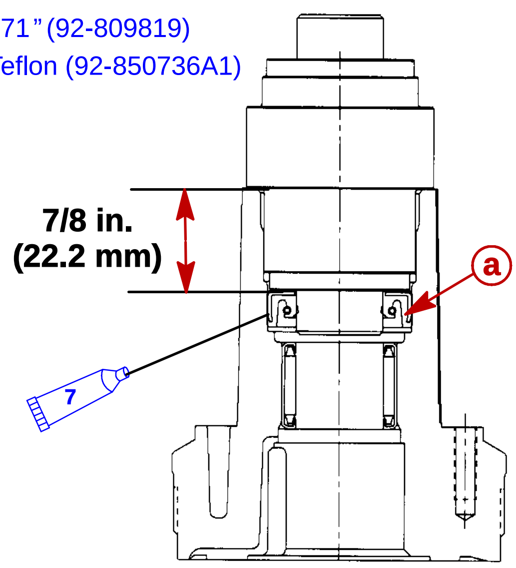


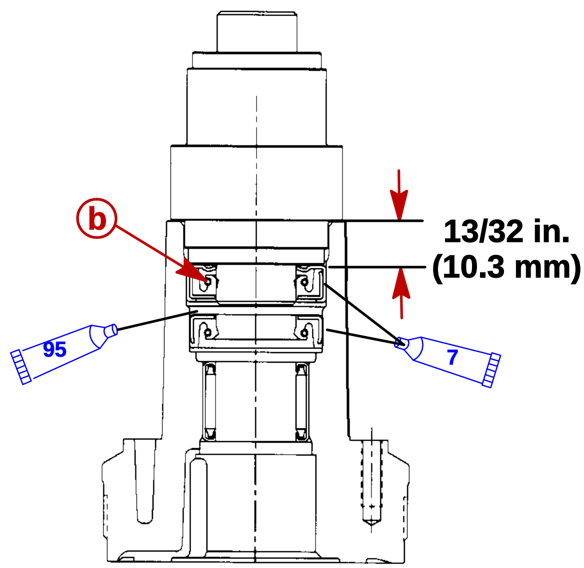
a-Suitable Mandrel
b-Propeller Shaft Bearing
c-Lettered end of Bearing

5. Apply Loctite Type "271" to outer diameter of inner propeller shaft seal. Use installation tool (91-858776) to press inner seal into bearing carrier (lip of seal is facing inward) to a depth of 7/8 in. (22.2 mm) from end of bearing carrier housing.
6. Apply 2-4-C w/Teflon between seals.
7. Apply Loctite Type "271" to outside diameter of the outer propeller shaft seal. Rotate installation tool and press outer seal into bearing carrier (lip of seal is facing outward) to a depth of 13/32 in. (10.3 mm) from end of bearing carrier housing.

7 Loctite "271" (92-809819)
95 2-4-C w/Teflon (92-850736A1)



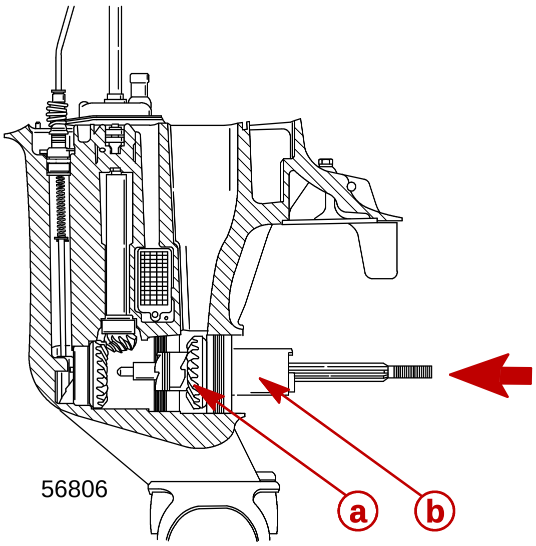


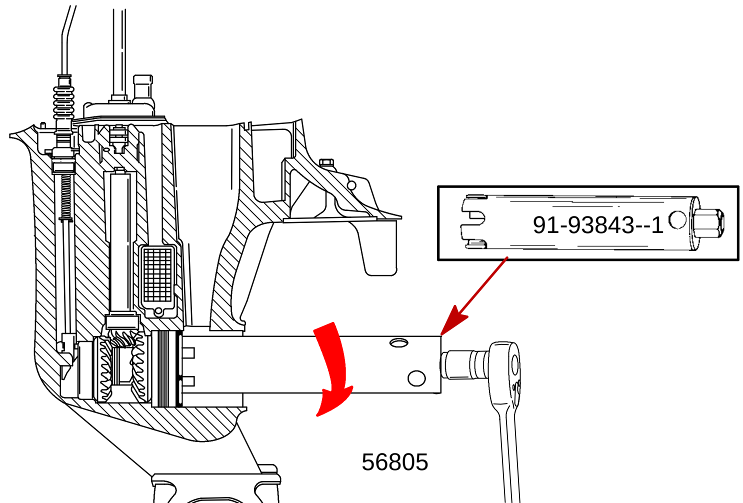


a-Inner Propeller Shaft Seal
b-Outer Propeller Shaft Seal

Bearing Carrier/Propeller Shaft Installation

1. Apply a small amount of 2-4-C w/Teflon between lips of propeller shaft oil seals. Apply 2-4-C w/Teflon to threads, O-ring groove and pilot diameter.
2. Slide reverse gear into bearing carrier assembly. Slide bearing carrier assembly over propeller shaft and thread it into propeller shaft cavity as-far-as possible by hand (LEFT HAND THREAD).
3. Torque bearing carrier using Special Tool 91-93843--1. Torque to 80 lb-ft (108.5 Nm).



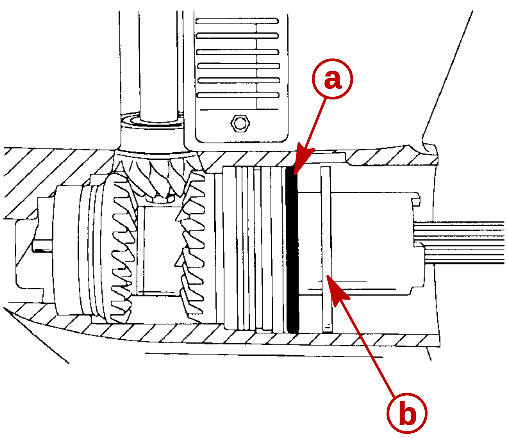


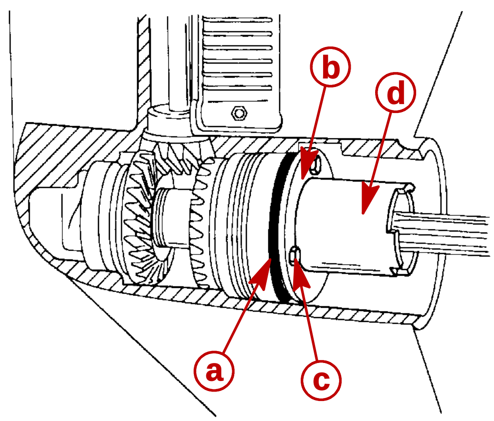
a-Reverse Gear
b-Bearing Carrier Assembly

4. Install O-ring and O-ring retainer plate on bearing carrier.
5. Secure O-ring retainer plate to bearing carrier with 3 screws.

NOTE: *Orientate O-ring to prevent "pinching it".*

6. Torque screws to 65 lb-in. (7.2 Nm).

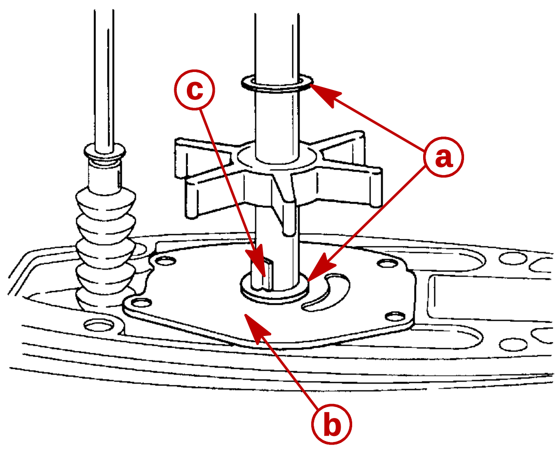




a-O-Ring
b-O-Ring Retainer Plate
c-Screws (3) Torque to 65 lb-in. (7.2 Nm)
d-Bearing Carrier

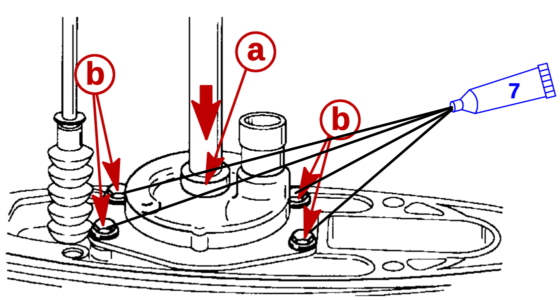
Water Pump

1. Slide a new face plate gasket and face plate over driveshaft and position them on gear housing.
2. Install nylon washer over driveshaft and set it flat against face plate.
3. Place impeller drive key on flat of driveshaft.
4. Slide new impeller over driveshaft. Align impeller keyway with drive key, then push impeller over drive key and against face plate. If reusing impeller (not recommended) note orientation of vane set.
5. Install nylon washer and set it flat against impeller.
6. Install new O-ring in water pump cover. Install cover assembly over driveshaft and down against impeller.



a-Nylon Washer
b-Face Plate
c-Drive Key

7. While pushing down on water pump cover assembly, rotate driveshaft clockwise to install impeller cover and seat cover against face plate.
8. Align mounting holes in gasket, face plate and water pump cover with mounting holes in gear housing. Install four (4) screws applying Loctite "271" and torque to 60 lb-in. (6.8 Nm).
9. Slide centrifugal slinger down drive shaft.



7 Loctite "271" (92-809819)

a-Centrifugal Slinger
b-Screws (4) Torque to 60 lb-in. (6.8 Nm).

Gear Housing Installation

9.9/15 Bigfoot (4 - Stroke)

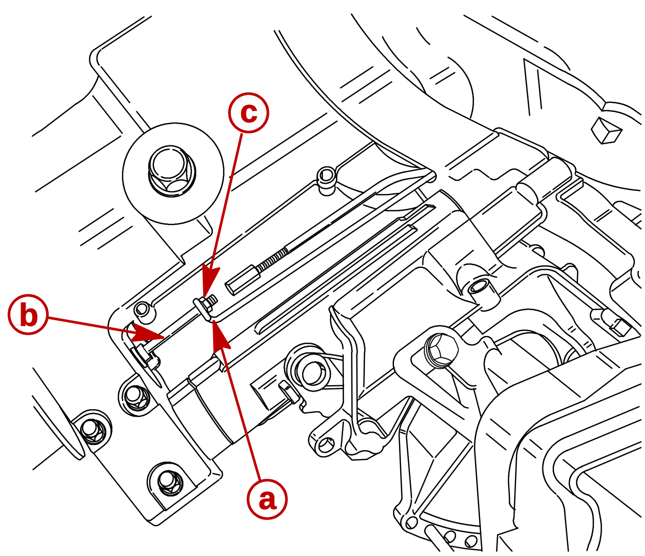
WARNING
To prevent accidental engine starting remove (and isolate) spark plug leads from spark plugs before installing gear housing

IMPORTANT: If water tube has been removed, follow installation procedure in Section 5. Water tube location is critical for proper alignment to water pump.

1. Tilt outboard to full "UP" position.
2. Place shift handle (tiller models) or shift lever (remote control models) into neutral.
3. Place gear housing into neutral by pushing down on the lower shift shaft (from forward gear) to neutral detent. (Propeller will rotate freely in either direction).
4. Coat splines of drive shaft with 2-4-C w/Teflon.
5. Guide gear housing onto drive shaft housing to aligning the following:
   - Keep mating surfaces of gear housing/drive shaft housing parallel.

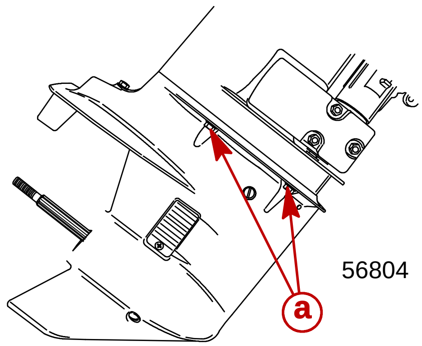
NOTE: *It may be necessary to rotate the flywheel to aid engagement of drive shaft splines to crankshaft splines.*

   - Insert drive shaft into the opening in the upper part of the drive shaft housing to align with crankshaft splines.
   - Guide lower shift shaft thru rubber seal/opening in lower drive shaft housing and up thru loop of reverse lock link rod.
   - Position water tube guide onto water tube.



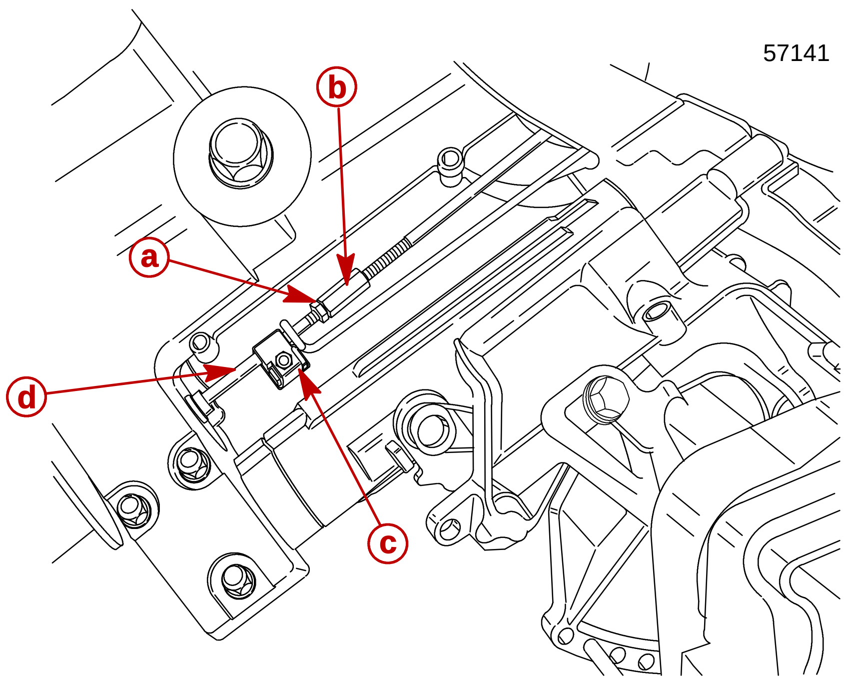
a-Reverse Lock Link Rod
b-Lower Shift Shaft
c-Jam Nut

6. Secure gear housing to drive shaft house with four (4) screws. Torque screws to 40 lb-ft (54.2 Nm).



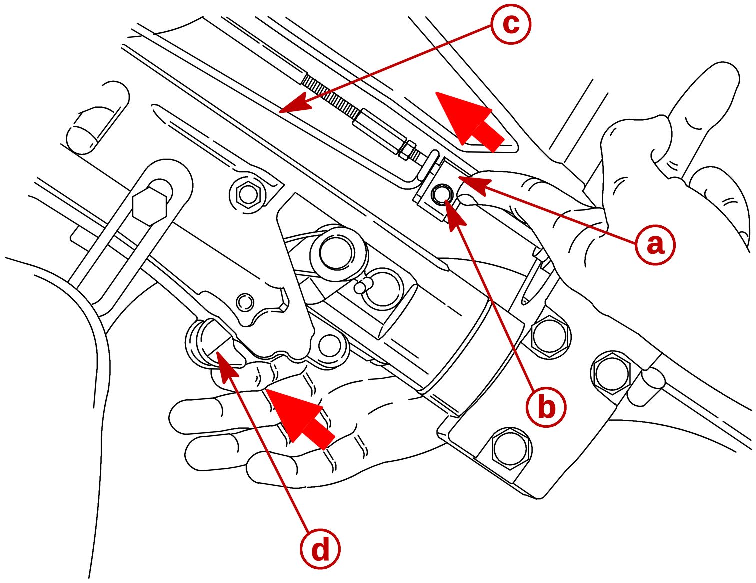
a-Screws (4) Torque to 40 lb-ft (54.2 Nm)

7. Thread (retained) 'jam" nut onto lower shift to expose five (5) threads above the nut.
8. Reconnect shift shaft coupling and tighten 'jam" nut against coupler.
9. Shift to forward gear.
10. Assemble reverse hook guide around lower shift shaft and tighten bolt/nut to allow adjustment.



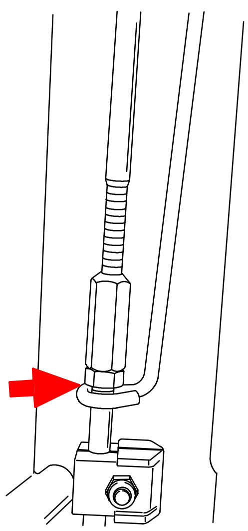
a-Jam Nut
b-Coupling
c-Reverse Hook Guide
d-Lower Shift Shaft

11. Lift and hold reverse lock hook in the full up position.
12. Slide reverse hook guide up shift shaft to make contact with loop of reverse lock link rod. DO NOT bend link rod. Tighten guide bolt/nut to a torque of 50 lb-in. (5.7 Nm).



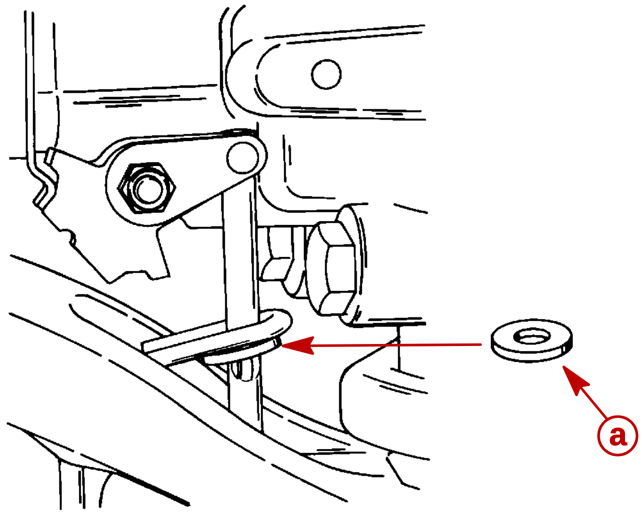
a-Reverse Hook Guide
b-Bolt/Nut - Torque to 50 lb-in. (5.7 Nm)
c-Reverse Lock Hook Link Rod
d-Reverse Lock Hook

13. Lower outboard to the normal operating position.
14. Check reverse lock operation as follows:
    - Forward Gear - Reverse lock fully released. Outboard will tilt up.
    - Neutral - Reverse lock engaged. Outboard will not tilt up.
    - Reverse Gear - Reverse lock fully engaged. Outboard will not tilt up.
15. Shift outboard into reverse and verify that free play exists between lower loop of reverse lock link rod and shift shaft coupling "jam".
16. If no free play exists, turn coupling up shift shaft a maximum of 1-1/2 turns and re-tighten jam nut against coupling.



20/25 (2 Stroke)

17. While turning drive shaft in a clockwise direction, pull up lightly on shift shaft until gear housing is in forward gear (propeller shaft turns clockwise).
18. Install flat washer (retained) onto shift shaft.



51187

a-Washer

IMPORTANT: Verify water tube (inside drive shaft housing) is connected to the water tube seal in the adaptor plate.

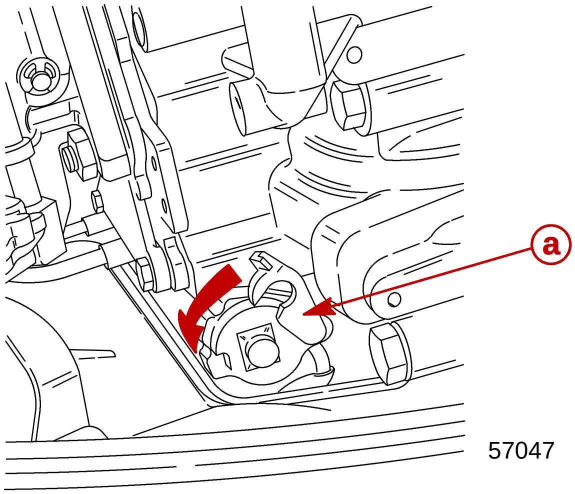
19. Position twist grip on tiller handle so that outboard is in forward gear.

NOTE: *It is not necessary to grease the drive shaft splines prior to installation of gear housing assembly. Splines receive internal engine lubrication during normal engine operation.*

20. Position gear housing so that drive shaft and shift shaft extend up into drive shaft housing.
21. Move gear housing up toward drive shaft housing while keeping machined surfaces parallel.
22. Guide shift shaft thru loop in the reverse lock rod.
23. Guide water tube into rubber seal in water pump cover.
24. Guide drive shaft into crankshaft.

NOTE: *It may be necessary to rotate the flywheel to aid engagement of drive shaft splines to crank shaft splines.*

25. Secure shift rod to horizontal shift shaft with retainer.



a-Retainer

26. Check shift operation as follows:

- Place shift lever in FORWARD. Gear housing should ratchet when propeller shaft is turned clockwise and resistance should be felt when propeller is turned counterclockwise.
- Place shift lever in NEUTRAL. Resistance should NOT be felt when propeller shaft is rotated in either direction.
- Place shift lever in REVERSE. Resistance should be felt when propeller shaft is rotated in either direction.
- If shift operation is not as described, recheck the coupler installation procedure.

Trim Tab Adjustment and Replacement

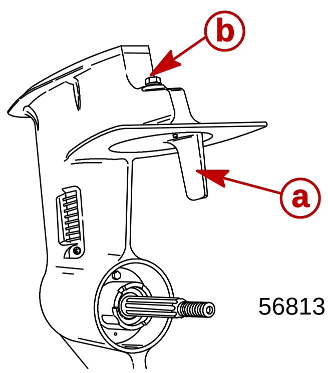
IMPORTANT: The trim tab made of a special alloy to aid in protecting the drive shaft housing and gear housing from galvanic corrosion (corrosion and pitting of metal surfaces). Do not paint or place protective coating on the trim tab, or trim tab corrosion protection function will be lost.

Replace trim tab if 50% (or more) corroded. Mark location of old trim tab on anti-ventilation place before removal; install new trim tab in same location.

1. Check trim tab position.
2. Operate boat at the speed at which it would normally be operated.
3. If the boat pulls to the right (starboard), the trailing edge of trim tab must be moved to the right. If the boat pulls to the left (port). the trailing edge of trim tab must be moved to the left.
4. If necessary, adjust trim tab.
5. Shift engine control into NEUTRAL and turn ignition key to "OFF" position.

NOTE: *Loosen trim tab bolt sufficiently to allow trim tab to disengage from locking ridges in gear case before attempting to move tab. DO NOT strike trim tab with a hard object to make adjustments.*

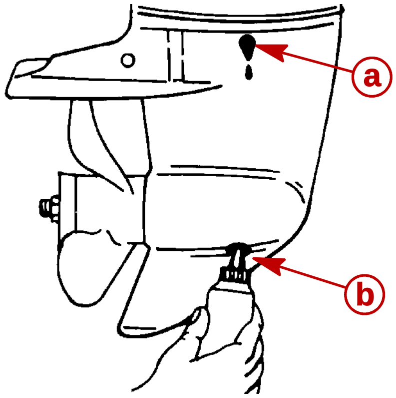
6. Repeat steps 2-4 as required to reduce steering torque.



a-Trim Tab
b-Retaining Bolt

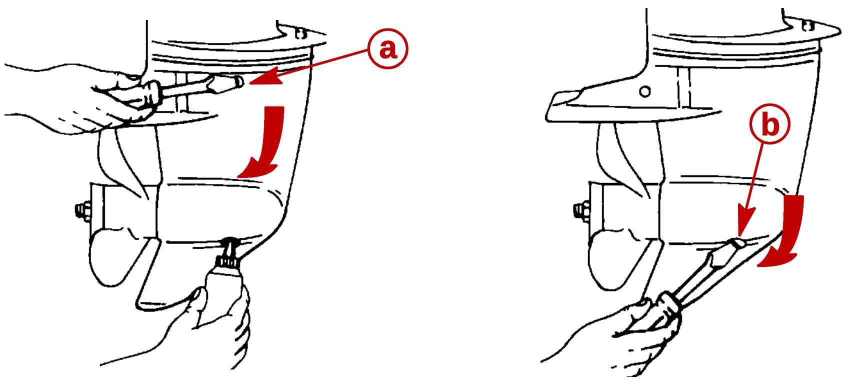
Filling Gear Housing with Lubricant

1. Place outboard in a vertical operating position.
2. Remove vent plug from vent hole.
3. Place lubricant tube into the fill hole and add lubricant until it appears at the vent hole.



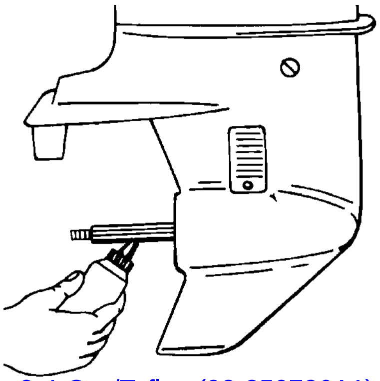
a-Vent Hole
b-Lubricant Tube

4. Install the vent plug and sealing washer before removing the lubricant tube.
5. Remove lubricant tube and reinstall cleaned fill/drain plug and sealing washer.



a-Vent Plug
b-Fill Plug

6. Apply a liberal coat of 2-4-C w/Teflon (92-825407A12) to propeller shaft splines.



95 2-4-C w/Teflon (92-850736A1)

7. Install thrust hub cap on thrust hub.

LOWER UNIT

Section 6B - Jet Drive

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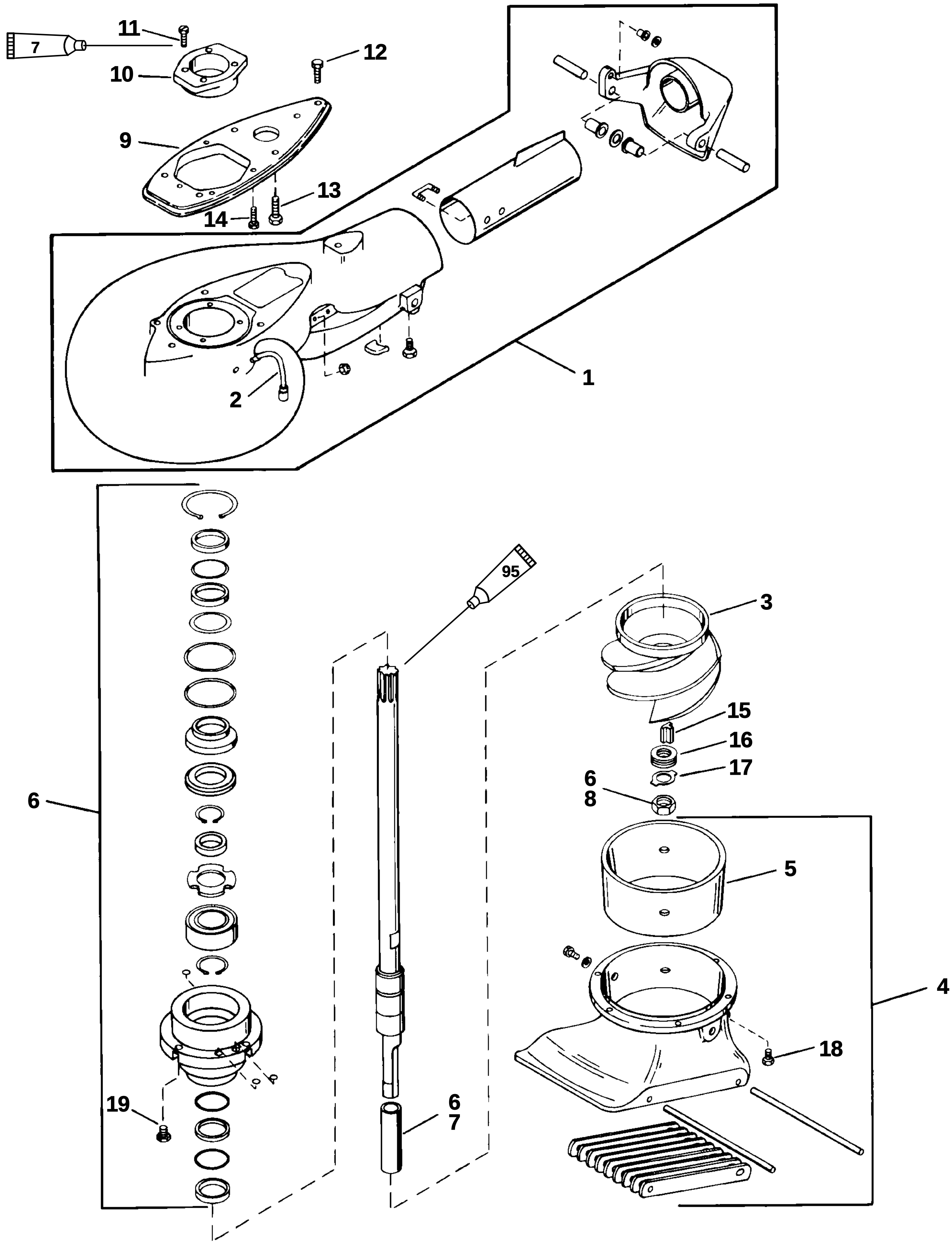
6
B

Specifications

JET DRIVE	**Impeller Liner Clearance**	0.030 in. (0.8 mm)

Jet Pump Assembly (S/N 0G157845 & Below)



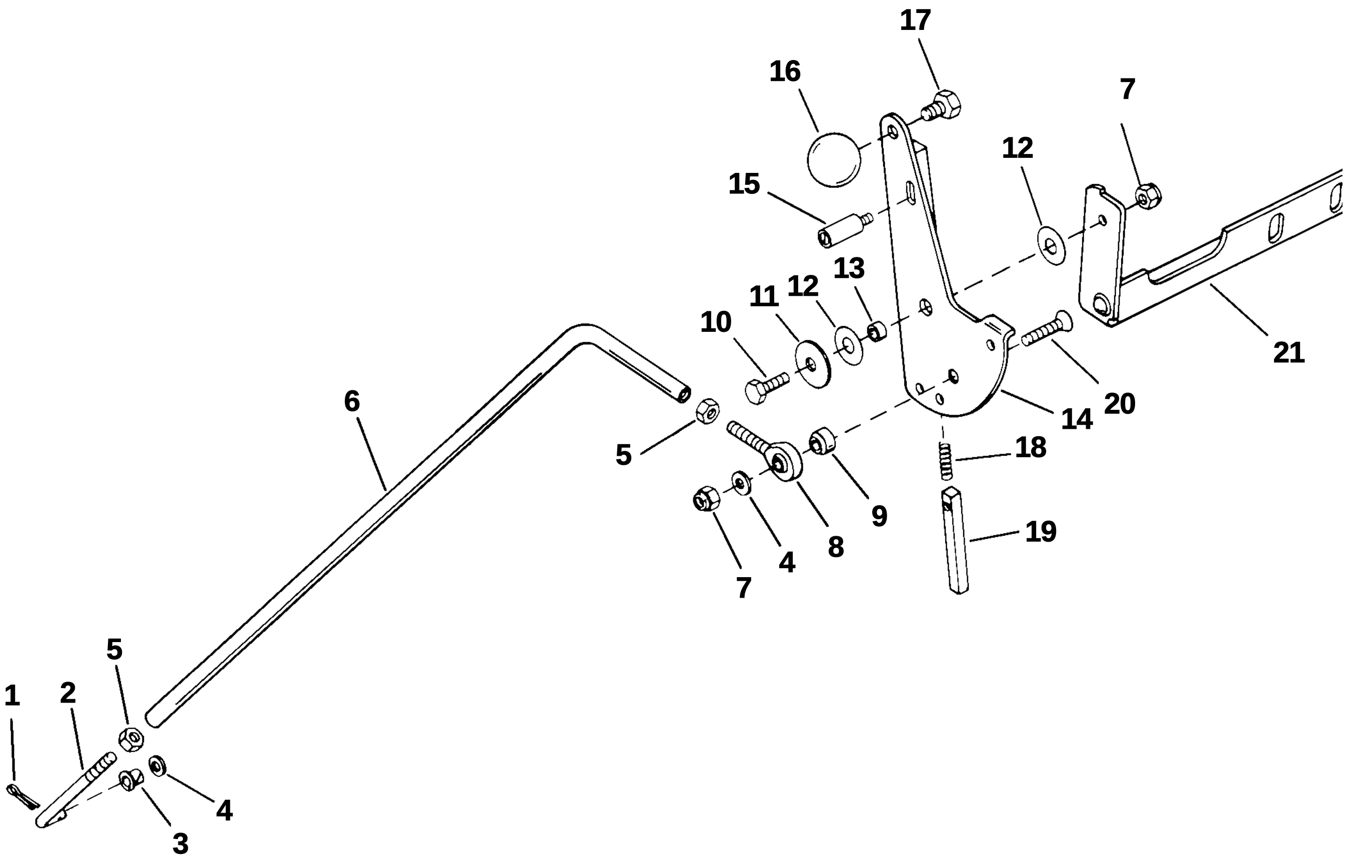
7 Loctite 271 (92-809820)

95 2-4-C With Teflon (92-825407A12)

Jet Pump Assembly (S/N 0G157845 & Below)

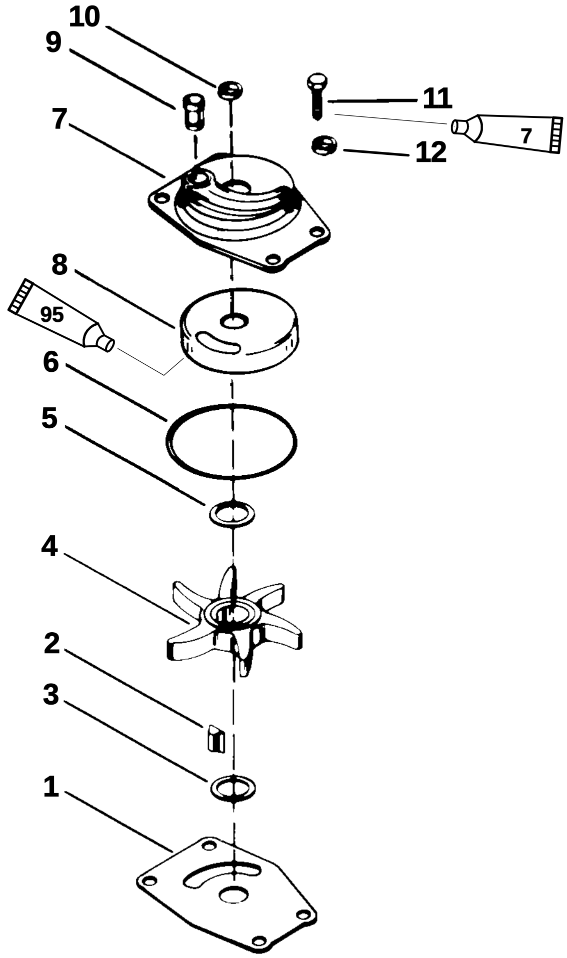
REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
–	1	JET PUMP ASSEMBLY **(BLACK)**			
–	1	JET PUMP ASSEMBLY **(GRAY)**			
1	1	HOUSING–pump			
2	1	HOSE–lube			
3	1	IMPELLER			
4	1	HOUSING–intake			
5	1	LINER			
6	1	DRIVESHAFT			
7	1	SLEEVE			
8	1	NUT			
9	1	ADAPTOR			
10	1	BASE–pump			
11	4	SCREW (10-32 x 1)	35		4.0
12	1	SCREW (.375-16 x 1-1/4)		23.0	31.2
13	4	SCREW (.312-18 x 2)	160	13.0	18.1
14	4	SCREW			
15	1	KEY–impeller			
16	8	SHIM–impeller			
17	1	TAB WASHER			
18	6	SCREW (.250-20 x 3/4)	96	8.0	10.8
19	2	SCREW (10-24 x 5/8)	30		3.4

Jet Linkage (S/N 0G157845 & Below)



REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
1	1	COTTER PIN			
2	1	ROD END			
3	1	BUSHING			
4	2	WASHER			
5	2	NUT (1/4-28)			
6	1	SHIFT ROD			
7	2	NUT			
8	1	ROD END			
9	1	SPACER			
10	1	SCREW (1/4-20 x 3/4)			
11	1	WASHER			
12	2	WASHER			
13	1	BUSHING			
14	1	LEVER ASSEMBLY			
15	1	SCREW			
16	1	KNOB			
17	1	SCREW (.312-18 x 1/2)			
18	1	SPRING			
19	1	SHAFT			
20	1	SCREW (1/4-20 x 1-1/4)			
21	1	LEVER MOUNT			

Jet Water Pump Components

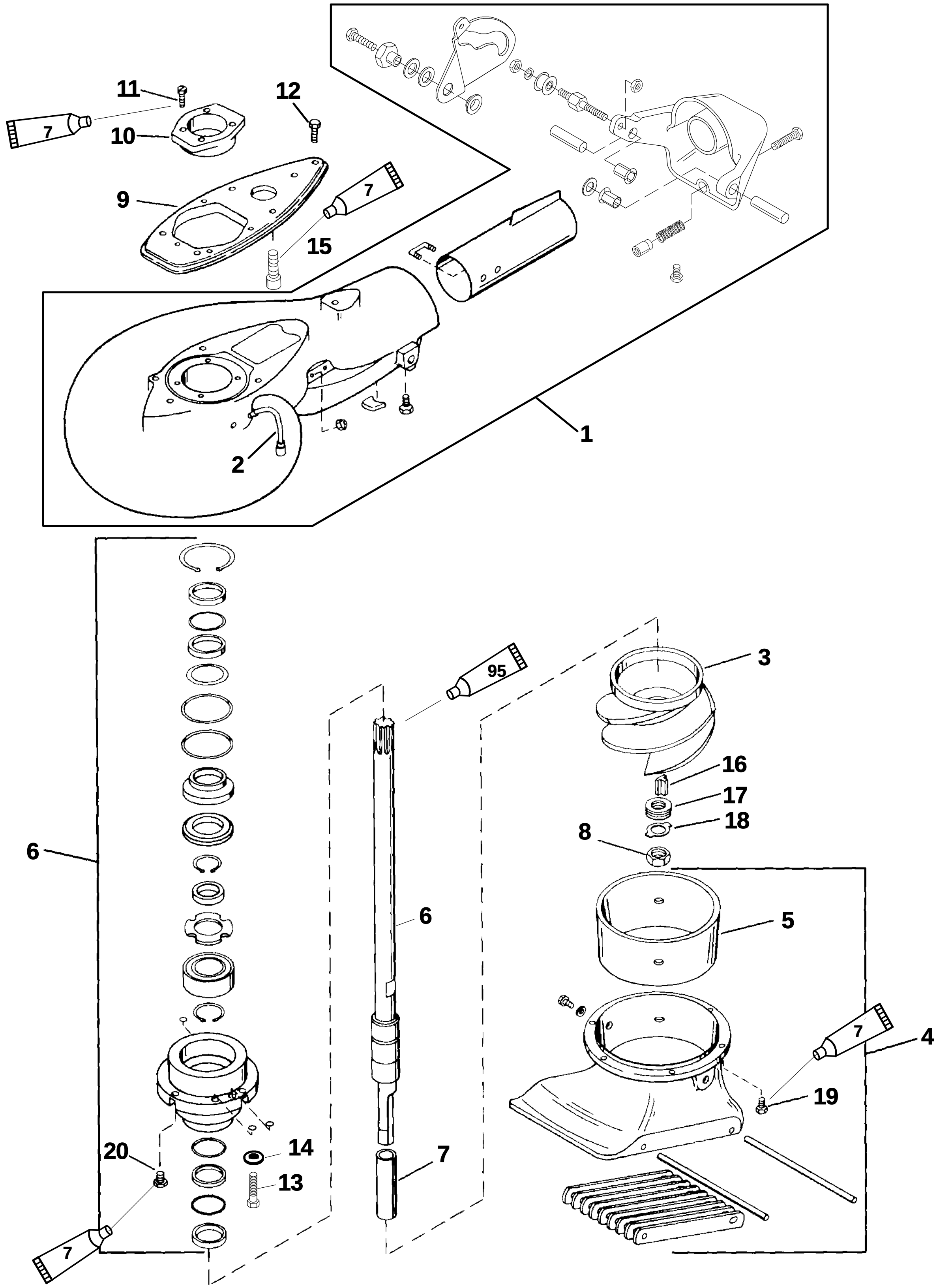


7 Loctite 271 (92-809820)

95 2-4-C With Teflon (92-825407A12)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
1	1	FACE PLATE			
2	1	WASHER-impeller			
3	1	KEY-Impeller Drive			
4	1	IMPELLER			
5	1	WASHER-impeller			
6	1	O RING-water pump			
7	1	WATER PUMP ASSEMBLY			
8	1	INSERT			
9	1	SEAL-water tube			
10	1	RING-driveshaft - rubber			
11	4	SCREW (M6 x 16)	70	5.8	7.9
	4	SCREW (M5 x 16)	70	5.8	7.9
12	4	BUSHING (Use with M5 X 16 REF. #11)			

Jet Pump Assembly (S/N 0G157846 & Up)



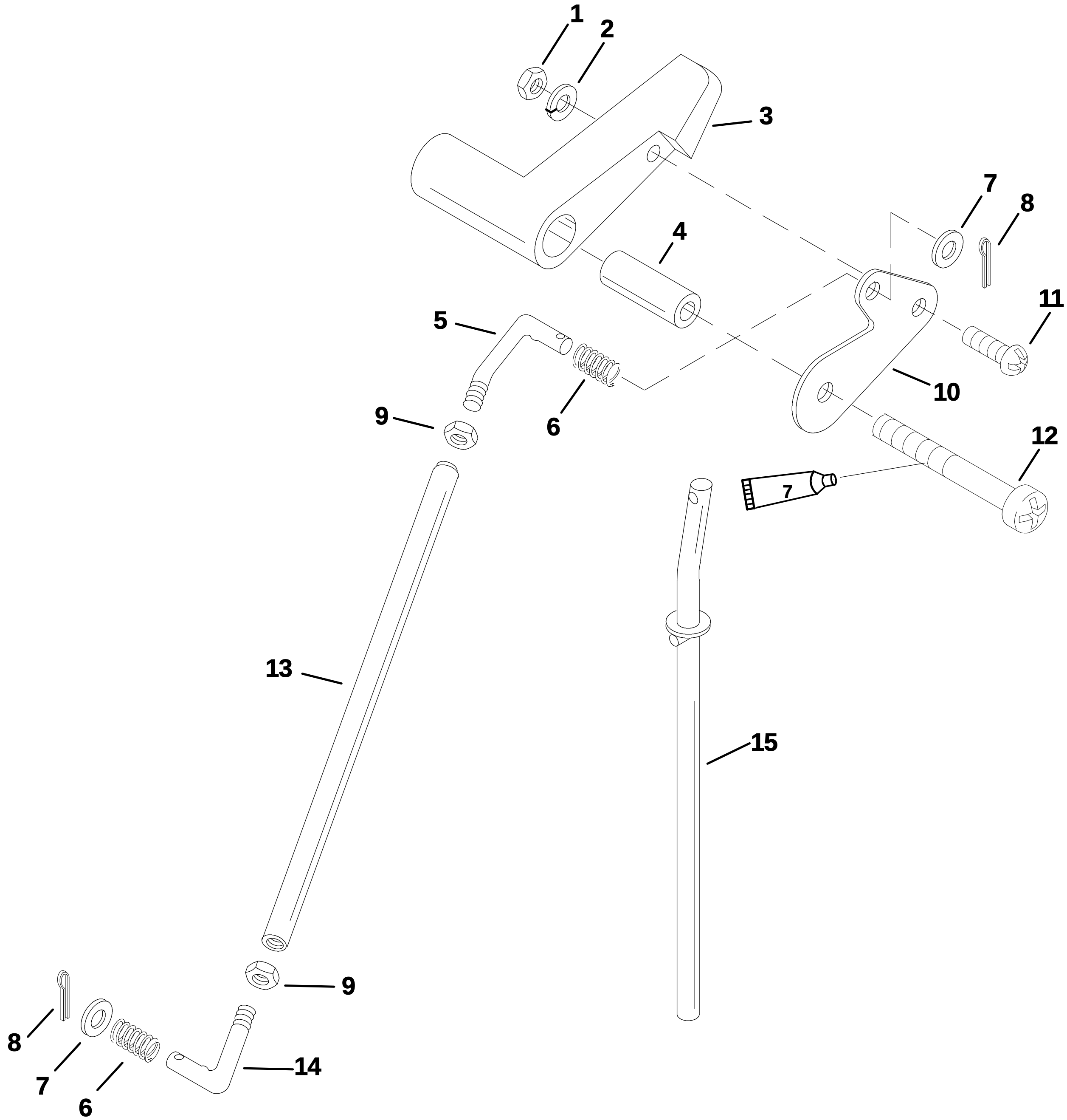
7 Loctite 271 (92-809820)

95 2-4-C With Teflon (92-825407A12)

Jet Pump Assembly (S/N 0G157846 & Up)

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb. in.	lb. ft.	N·m
–	1	JET PUMP ASSEMBLY			
1	1	HOUSING–pump			
2	1	HOSE–lube			
3	1	IMPELLER			
4	1	HOUSING–intake			
5	1	LINER			
6	1	DRIVESHAFT			
7	1	SLEEVE			
8	1	NUT	Drive Tight		
9	1	ADAPTOR			
10	1	BASE–pump			
11	4	SCREW (10-32 x 1)	30	2.5	3.4
12	1	SCREW (.375-16 x 1-1/4)	265	22	29.9
13	4	SCREW (.312-18 x 2)	155	12.9	17.5
14	4	WASHER			
15	4	SCREW (M10 x 35)	300	25	33.9
16	1	KEY–impeller			
17	8	SHIM–impeller			
18	1	TAB WASHER			
19	6	SCREW (.250-20 x 3/4)	70	5.8	7.9
20	2	SCREW (10-24 x 5/8)	30	2.5	3.4

Jet Linkage (S/N 0G157846 & Up)



Loctite 271 (92-809820)

Jet Linkage (S/N 0G157846 & Up)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	NUT			
2	1	LOCKWASHER			
3	1	SHIFT HANDLE (Use without Ref. #4)			
3	1	SHIFT HANDLE (Use with Ref. #4)			
4	1	SPACER–sleeve			
5	1	ROD END			
6	2	SPRING			
7	2	WASHER			
8	2	COTTER PIN			
9	2	NUT	70	5.8	7.9
10	1	SHIFT LEVER			
11	1	SCREW (10-32 x 3/4)			
12	1	SCREW (10-32 x 2-1/2)	30	2.5	3.4
13	1	SHIFT ROD			
14	1	ROD END			
15	1	TILT LATCH ROD			

Selecting A Boat That Is Best Suited For Jet Power

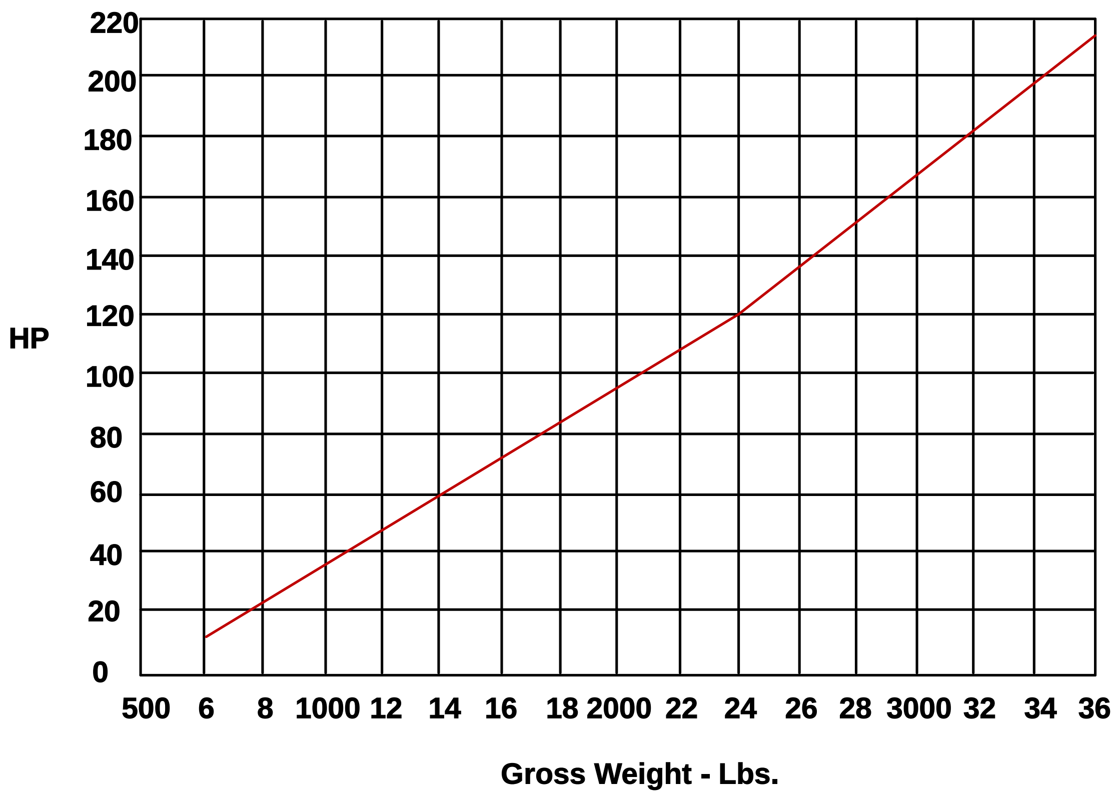
To obtain the best performance from the jet drive, the boat should have the following features:

1. The boat should be as light as possible.
2. The boat should have hull and transom that is designed for use with a jet drive.
3. The boat should be at least 13 feet in length.

Engine Horsepower Selection

A boat operating at slow speed requires considerably more depth than one which is planing on the surface of the water. It is important therefore to use sufficient horsepower and not to overload your boat beyond its ability to plane. See the following table.

The following table is based on experience obtained with sled-type boats using outboard jets. The gross weights shown includes the outboard, boat, people, and all the gear carried. For a given horsepower loading beyond these weights will give less than good performance.



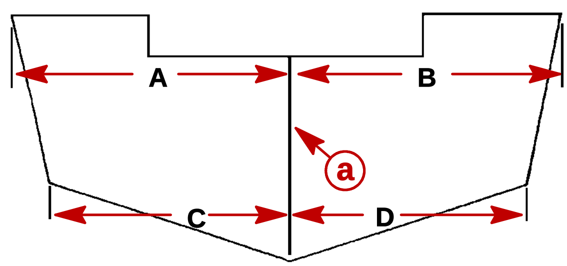
Transom Height of the Boat

Outboards with jet drives will be mounted approximately 7 inches higher on the transom than propeller driven outboards. This requires outboards that have a 15 in. shaft length to be installed on boats having a 22 in. transom height and outboards that have a 20 in. shaft length to be installed on boats having a 27 in. transom height.

If the boat transom is of insufficient height, and the outboard cannot be installed to the recommended height, contact the boat manufacturer for recommended procedure to build up the boat transom.

Locate Centerline Of The Outboard

Locate (and mark with pencil) the vertical centerline (a) of boat transom.



a - Centerline of Transom

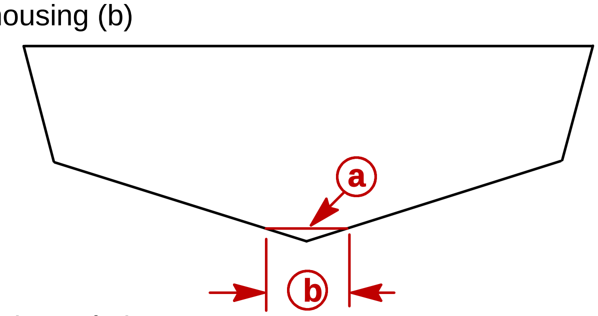
Outboard Mounting Height

The initial outboard mounting height setting will work good for most applications, however, because of different boat/hulls designs, the setting should be rechecked by test-running the boat. Refer to Water Testing.

- Installing the outboard too high on the transom will allow the water intake to suck in air and cause cavitation. (Cavitation will cause the engine to overspeed in spurts and reduce thrust). This condition should be avoided by proper height setting.
- Installing the outboard too low on the transom will allow excessive drag.

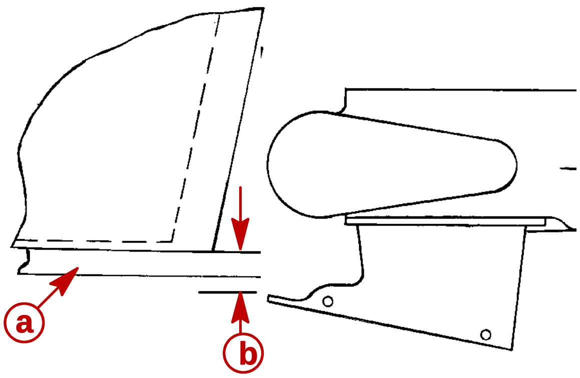
SETTING OUTBOARD MOUNTING HEIGHT ON BOATS WITH "V" BOTTOM HULLS

1. Measure the width of the leading edge on the water intake housing. Make a horizontal line (a) on the transom up from the "V" bottom the same length as the width of the water intake housing (b)



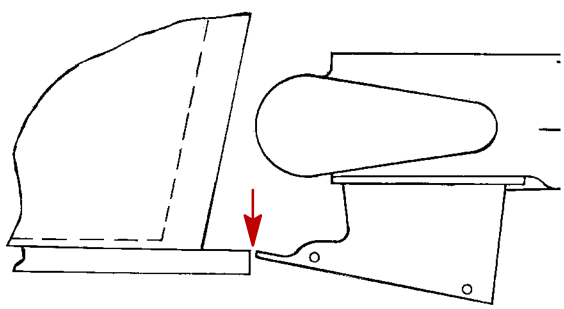
a - Horizontal Line
b - Width of Water Intake Housing

2. Place (center) the outboard on the boat transom so that the transom brackets are resting on top of the transom. Temporarily fasten the outboard to the transom using two C-clamps.
3. Position the outboard in a vertical position.
4. Line up a straight edge along the bottom of the boat with the horizontal line made in Step 1 and measure the distance between the horizontal line and top front edge of the water intake housing.



a - Straight Edge
b - Top Front Edge of Water Intake Housing

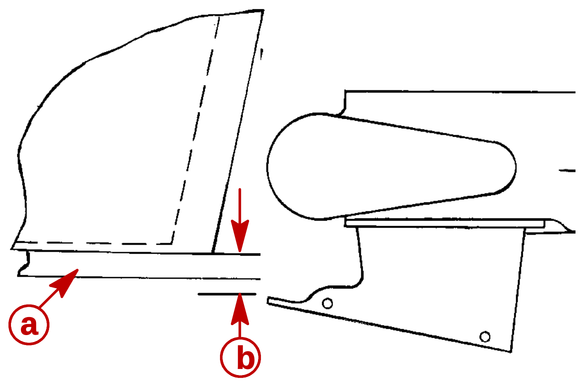
5. Raise The outboard up on the transom the distance measured in Step 4. Use a straight edge and recheck the mounting height. The top edge of the water intake housing should be lined up with the horizontal line made in Step 1.



6. Fasten outboard to the transom at this height.

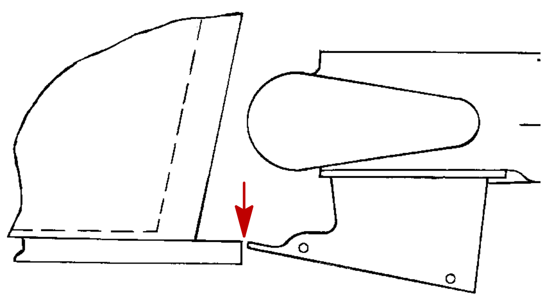
SETTING OUTBOARD MOUNTING HEIGHT ON BOATS WITH FLAT BOTTOM HULLS

1. Place (center) the outboard on the boat transom so that the transom brackets are resting on top of the transom. Temporarily fasten the outboard to the transom using two C-clamps.
2. Position the outboard in a vertical position.
3. Place a straight edge along the bottom of the boat as shown and measure the distance between the bottom of the boat and top front edge of the water intake housing.



a - Straight Edge
b - Top Front Edge of Water Intake Housing

4. Raise the outboard up on the transom the distance measured in Step 3. Use a straight edge and recheck the mounting height. The top edge of the water intake housing should be in line with the bottom of the boat as shown.



5. Fasten outboard to the transom at this height.

Water Testing

Checking for Cavitation

Making the initial outboard height setting should be close to the optimum setting for the outboard. However because of the hull design of some boats, obstructions or imperfections in the hull ahead of the water intake may require this setting to change in order to prevent cavitation at running speeds.

When operating the boat, the outboard drive shaft should be vertical when planing or tilted toward the boat in order to provide a scooping angle on the water intake. Tilting the outboard out beyond a vertical position reduces the scoop angle and can cause impeller slippage and cavitation. If the angle of the boat transom does not allow the drive shaft to be positioned vertically, a Wedge kit should be installed behind the transom brackets to increase the tilt-in angle.

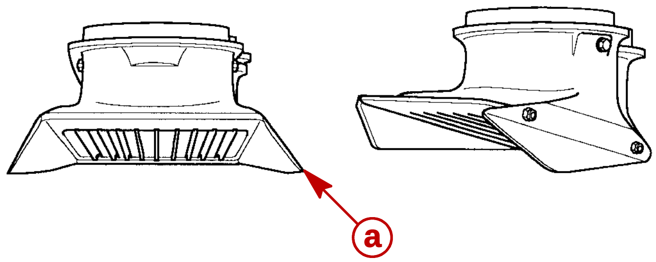
NOTE: *Slight cavitation in sharp turns and rough water is acceptable but excessive cavitation is harmful to the outboard and should be avoided.*

Test run the boat. If cavitation occurs (air enters the pump causing loss of thrust, engine over-speeds erratically), the first thing to try is lowering the outboard height 1/4 in. This can be accomplished by elongating the drilled mounting holes in the boat transom by 1/4 in.

If cavitation still exists after lowering the outboard 1/4 in.
(6.35 mm), it maybe helpful to seek advice from the boat manufacturer.

A number of other options are available to further reduce cavitation.

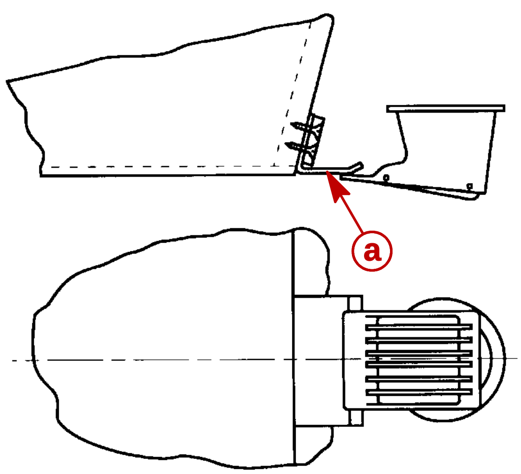
1. Water intake fin kit (a) – Available from the Specialty Mfg. Co. for jet models 30 thru 140. The purpose of these fins is to ram more water into the intake and shield the forward sides of the intake from the entrance of air. This kit will help reduce cavitation when running with the wind in a chop.



a - Intake Fin Kit

Water Intake Fin Kit Part No.1186 for jet models 45 thru 140 and Part No. 1185 for jet model 30 is available from:
Specialty Mfg. Co.
2035 Edison Ave.
San Leandro, CA 94577

2. Rough Water Plate (b) – Using this type of plate may be helpful in reducing cavitation when running in windy rough water conditions where air is sucked-in the water intake when jumping waves. Install a 1/32 in. (0.794 mm) metal plate that extends from the hull bottom to the top of the water intake housing. This plate tends to reduce air intake as well as reduce spray.



a - Rough Water Plate

Shift Link Rod Adjustment

WARNING

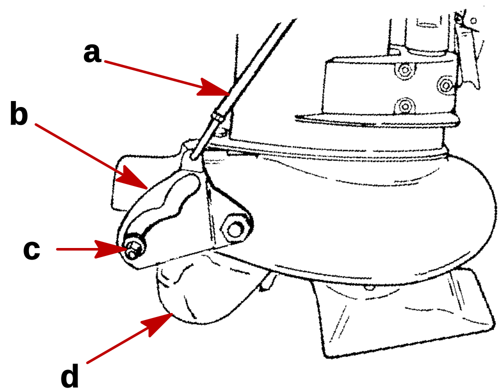
The shift link rod must be adjusted to lock the reverse gate against unexpected engagement (caused by water pressure hitting the gate) while operating the boat in forward. Activation of the reverse gate will cause sudden unexpected stopping of the boat. Sudden stopping may cause occupants to be thrown within the boat or even out of the boat. This action may result in serious injury or death.

Checking Shift Link Rod Adjustment

Check the shift link rod (a) adjustment in forward shift position. The correct adjustment will position the shift cam (b) far enough on the roller (c) in order to lock the the reverse gate (d) into forward position. You should not be able to forcibly push up the reverse gate toward neutral. Pull on the reverse gate by hand to verify this.

Adjusting Shift Link Rod

1. Place the shift handle into full forward shift position.
2. Adjust the length of the shift link rod (a) so that roller (c) is at the full end of travel (bottom) in the shift cam (c) when the shift handle is in full forward.



a - Shift Link Rod
b - Shift Cam
c - Roller
d - Reverse Gate

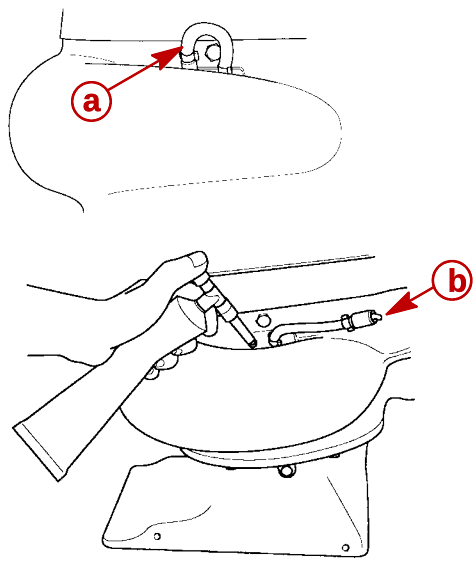
Lubricating the Drive Shaft Bearing

Recommended Lubrication - Use Quicksilver 2-4-C w/Teflon, or Lubriplate 630-AA Grease.

IMPORTANT: It is important that you do not use a general-all-purpose grease for this bearing. The lubricant we recommend is a water resistant grease of the proper consistency for this application. If you use a substitute grease, be sure that it is water resistant and of the same consistency.

Frequency of lubrication - We recommend lubricating the drive shaft bearing after each day's use and after every 10 hours of operation. After every 30 hours of operation, pump in extra grease to purge out any moisture.

Lubricating Procedure - Pull vent hose off the grease fitting. Pump in grease through the grease fitting until excess grease starts to exit the vent hose.



a - Vent Hose
b - Grease Exiting Vent Hose

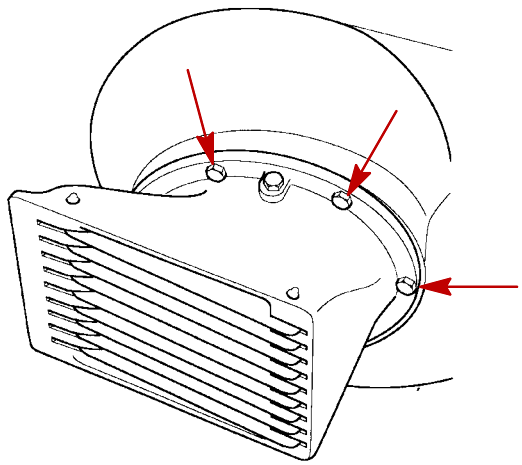
Reconnect the vent hose onto the grease fitting after greasing.

After 30 hours of operation, pump in extra grease to purge out any moisture. Visually inspecting the purged grease at this time will give you an indication of conditions inside the bearing housing. A gradual increase in moisture content, indicates seal wear. If the grease begins to turn dark, dirty gray, the drive shaft bearing and seals should be inspected and replaced if necessary. Some discoloration of the grease is normal during the break-in period on a new set of seals.

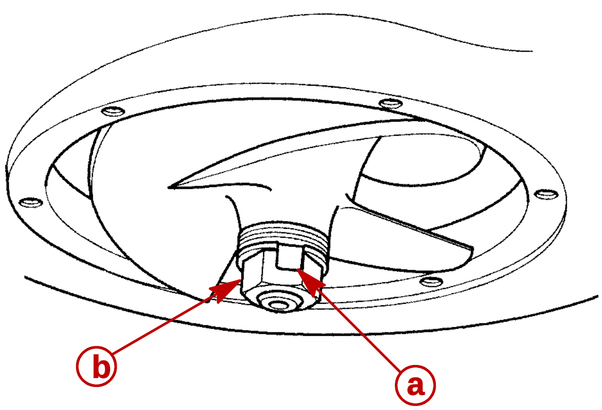
Impeller Removal and Installation

REMOVAL

1. Shift outboard to NEUTRAL (N) position.
2. Remove spark plug leads to prevent engine from starting.
3. Remove the water intake housing that is fastened with six screws.



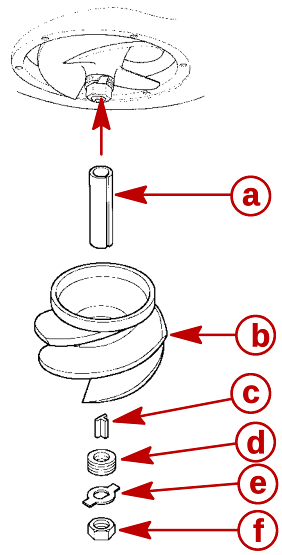
4. Straighten the bent tabs on the impeller nut retainer and remove the impeller nut.
5. Pull impeller straight off the shaft. If the impeller is tight, use a hammer and block of wood to rotate the impeller (clockwise) on the shaft until the keyway is directly above the flat on the shaft. This will free the jammed key and allow removal.



a - Tab
b - Nut

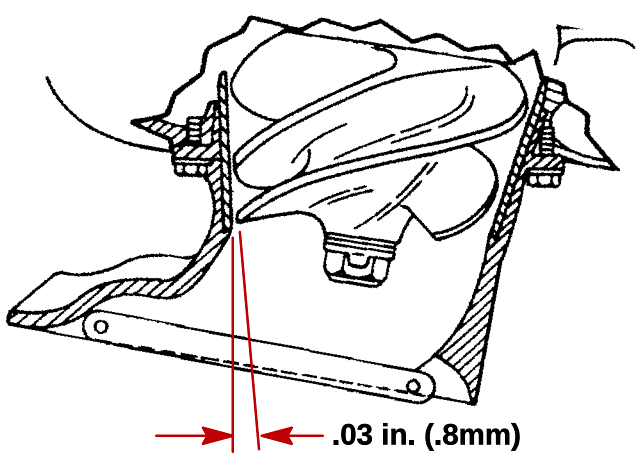
INSTALLATION

1. Grease the drive shaft, shear key, and impeller bore. Place the plastic sleeve (a) inside the impeller (b) and install impeller, shear key (c), shims (d) nut retainer (e), and impeller nut (f). Turn the nut tight on the shaft to remove any play between the impeller and shaft. If the tabs on the retainer do not line up with the flats on the nut, remove the nut and turn the retainer over and re-tighten the nut again.

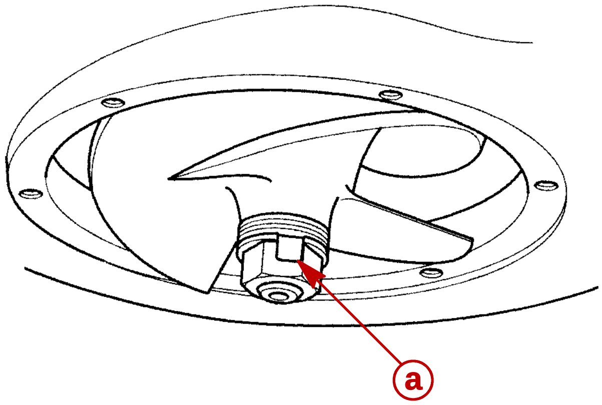


a - Plastic Sleeve
b - Impeller
c - Shear Key
d - Shims
e - Nut Retainer
f - Impeller Nut

2. Temporarily reinstall the water intake housing in order to check for impeller clearance. The clearance between the impeller and liner should be 0.030 in. (0.8 mm). Shim washers can be transferred to either side of the impeller to raise or lower the impeller to the correct clearance setting. The water intake housing can be shifted side ways a small amount in order to center the liner.



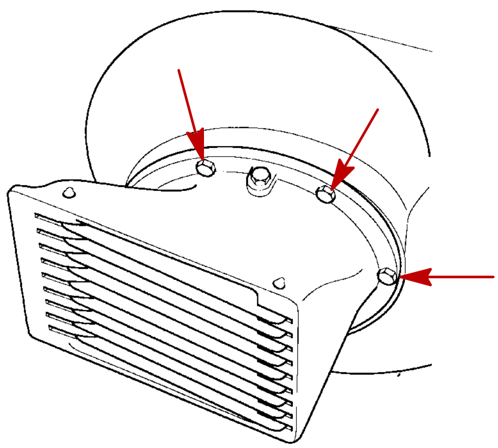
3. After setting the impeller height, tighten the impeller nut snug with a wrench. Secure impeller nut by bending tabs (a) against the flats on the impeller nut.



a - Tabs

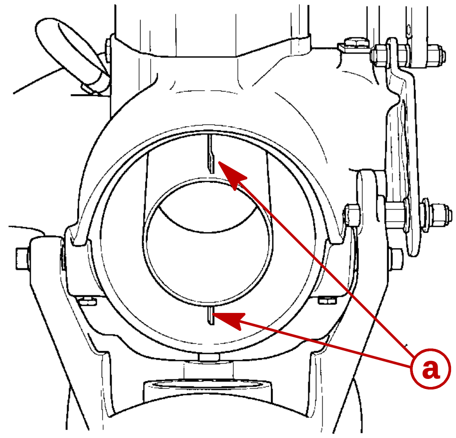
4. Reinstall the water intake housing with six bolts. Check clearance around the impeller to make sure the water intake housing is centered and not rubbing against the liner. Torque mounting bolts to 100 lb. in. (11.3 N·m).

NOTE: *If the outboard is used in salt water, apply Quicksilver Anti-Corrosion Grease around the entire mounting flange on the water intake housing and also to the threads on the six mounting bolts.*



Steering Pull Adjustment

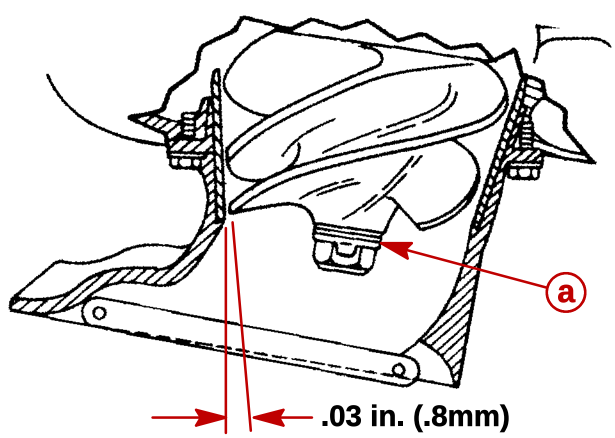
The steering on some boats will have the tendency to pull towards starboard. This pulling condition can be corrected by using a pliers and bending the ends of the exhaust fins (a) 1/16 in. (1.5 mm) toward the starboard side of the outboard.



a - Exhaust Fins

Impeller Clearance Adjustment

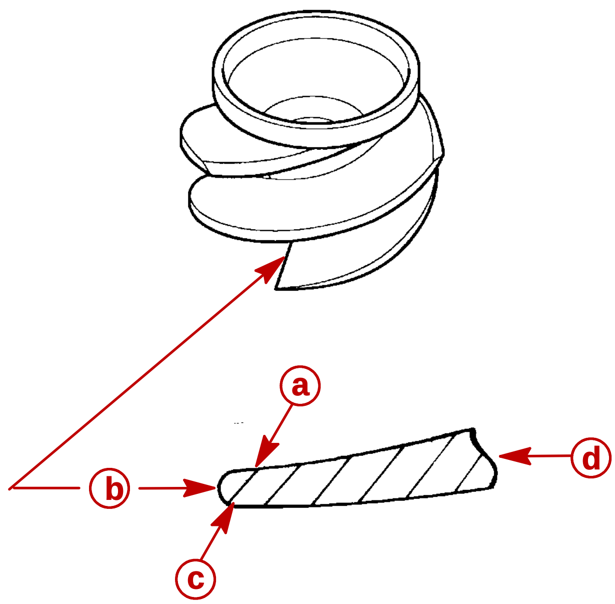
1. The impeller should be adjusted so there is approximately 0.030 in. (0.8 mm) clearance between the impeller edge and liner. Operating the jet drive in waters that contain sand and gravel can cause wear to the impeller blades, and the clearance will start to exceed 0.030 in. (0.8 mm). As the blades wear, shims (a) located in the stack outside of the impeller can be transferred behind the impeller. This will move the impeller further down into the tapered liner to reduce the clearance.
2. Check the impeller clearance by sliding a feeler gauge through the intake grate and measure the clearance between the impeller edge and liner. If adjustment is required, refer to Impeller Removal and Installation.



a - Shims

Worn (Dull) Impeller

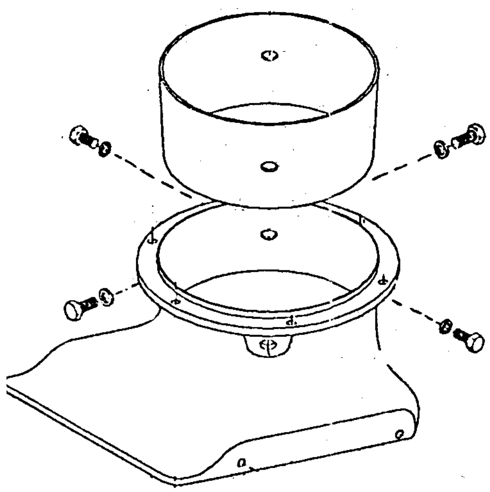
The intake of gravel through the pump can round off and wear the leading edges on the impeller. Some conditions you may experience from a worn impeller are (1) a noticeable performance loss, especially on acceleration, (2) difficultly getting the boat on plane, or (3) an increase in engine RPM at wide open throttle. Check the impeller blades occasionally for damage. Use a flat file to resharpen the leading edges as shown.



a - Do not sharpen or alter the top side lifting angle
b - Leading Edge
c - Sharpen to 1/32 in. (0.8mm) radius by removing material from bottom side only
d - Enlarged View

Liner Replacement

1. Mark the liner mounting bolts for reassembly into the same holes. Remove the bolts.
2. Remove the liner. If the liner is tight, tap on the inner edge of the liner with a long drift punch through the intake grate.



NOTE: *Apply grease to the liner mounting bolt threads before assembly.*

3. Position the liner into the water intake housing. Line up one of the liner bolts and lightly thread it in. It may be necessary to tap or press the liner into the water intake housing to locate the liner for installation of the remaining bolts. Torque bolts to 100 lbs. in. (11.3 N·m).
4. Grind off the ends of any bolts that may extend beyond the inner liner surface.

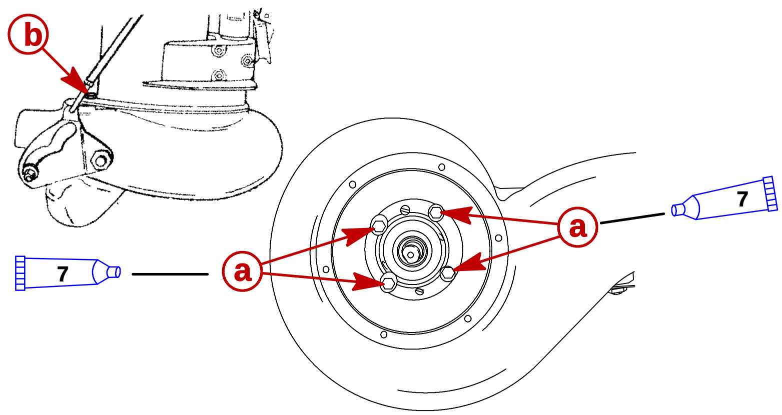
Jet Drive Removal and Installation

Removal

1. Remove water intake and impeller. Refer to Impeller Removal and Installation preceding.
2. Disconnect the shift linkage. Remove 5 bolts (shown) securing jet drive to drive shaft housing and remove jet drive.

Installation

1. Install jet drive with bolts shown.



7 Loctite 271 (92-809820)

a - Bolts (4) – Apply Loctite 271 to Threads and Torque to 25 lb. ft. (34.0 N·m)
b - Bolt (1) – Apply Loctite 271 to Threads and Torque to 23.0 lb. ft. (31.0 N·m)

Water Pump Removal and Installation

Removal

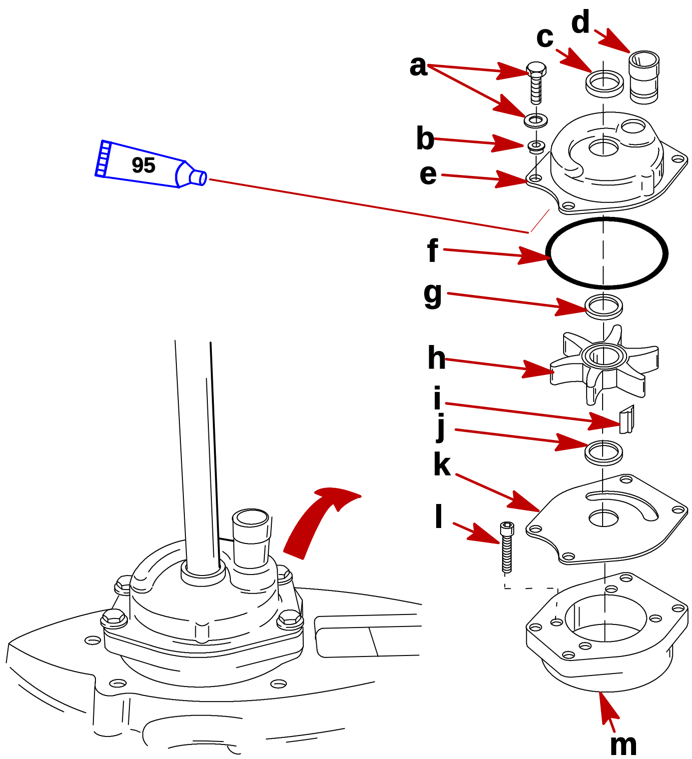
1. Remove water pump assembly as shown.

Installation

IMPORTANT: If impeller being installed has been previously used and vanes have taken a “set,” do not install the impeller with the vanes reversed from their previous “set” as vane breakage will occur shortly after unit is returned to service.

NOTE: *Apply a light coat of 2-4-C w/Teflon to inside of pump cover to ease installation of cover over impeller.*

1. Reassemble water pump assembly as shown. Rotate drive shaft CLOCKWISE while pressing water pump body down over impeller.



95 2-4-C With Teflon (92-825407A12)

a - Bolt and flat washer (4) – Apply Loctite 271 to threads
b - Bushing (4) – Used on earlier type water pumps
c - Rubber Ring
d - Seal – Water Tube
e - Pump Assembly
f - O-Ring
g - Washer
h - Impeller
i - Key
j - Washer
k - Face Plate
l - Screw (4) – Apply Loctite 271. Torque to 35 lb. in. (4.0 N·m)
m - Base

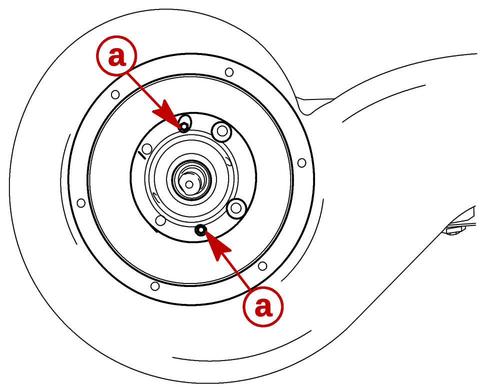
Bearing Carrier Removal and Installation

Removal

1. Remove water pump assembly and water pump base.
2. Remove 2 screws securing bearing carrier to jet drive. Remove bearing carrier.

Installation

Reinstall bearing carrier as shown.

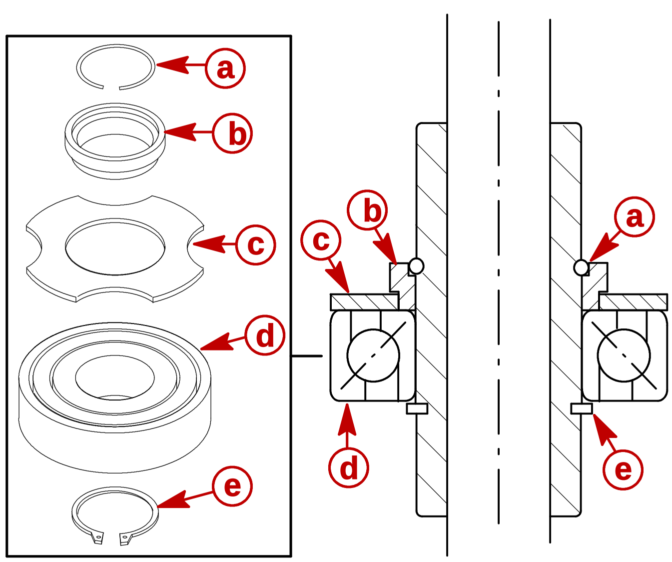


a - Screws (2) Apply Loctite 271 to Threads, Torque to 30 lb. in. (3.4 N·m)

Installing Drive Shaft Bearing

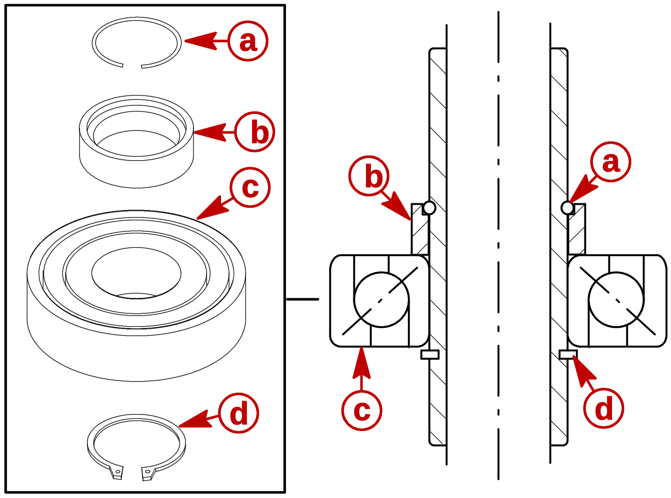
Single Bearing System (Small Diameter Bearing)

1. If removed, install the bearing thrust ring (a) into the groove on the drive shaft.
2. Install collar (b) onto the drive shaft. Install thrust washer (c) (gray Teflon coating side facing the ball bearing). Press the new ball bearing (d) onto the drive shaft, **pressing against the inner race only**. Press collar (b) over the thrust ring (a), locking it in its groove. Install snap ring (e) into drive shaft groove below the bearing.



Single Bearing System (Large Diameter Bearing)

1. If removed, install the bearing thrust ring into the groove on the drive shaft.
2. Install collar onto the drive shaft. Press the new ball bearing onto the drive shaft, **pressing against the inner race only**. Press collar over the thrust ring (a), locking it in its groove. Install snap ring into drive shaft groove below the bearing.

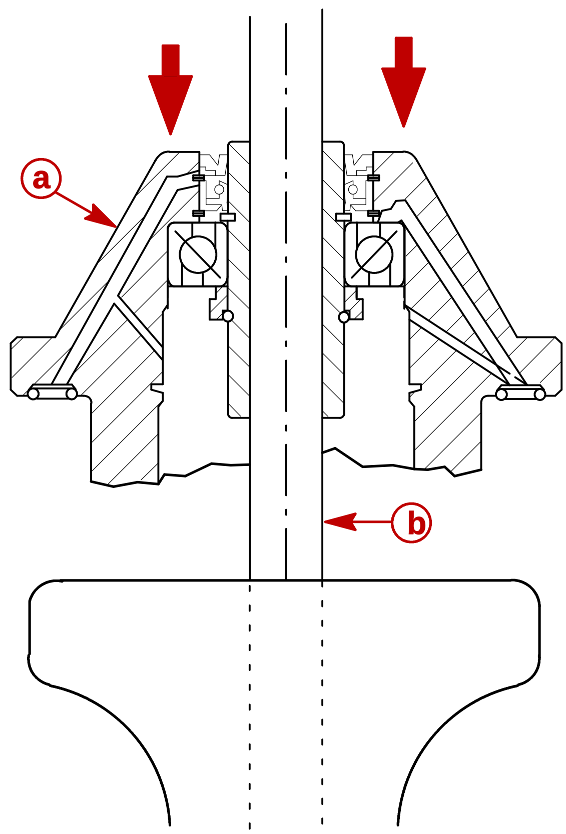


a - Bearing Thrust Ring
b - Collar
c - Ball Bearing
d - Snap Ring

Installing Drive Shaft

1. Lubricate the seals and inside bore of the bearing carrier (a).
2. Place the drive shaft ("b" impeller end facing up) into a vise.
3. Heat the bearing carrier (a) until it feels warm to the touch.
4. Place the bearing carrier (a) onto the drive shaft. Square up the inner bore with the ball bearing(s) and push the bearing carrier down until it bottoms-out against the bearing. It may be necessary to lightly tap bearing carrier onto the bearing(s) using a rubber hammer.

NOTE: *Only a light pressing force is needed to press on the bearing carrier. It may be necessary to lightly tap the bearing carrier onto the bearing(s) using a rubber hammer.*



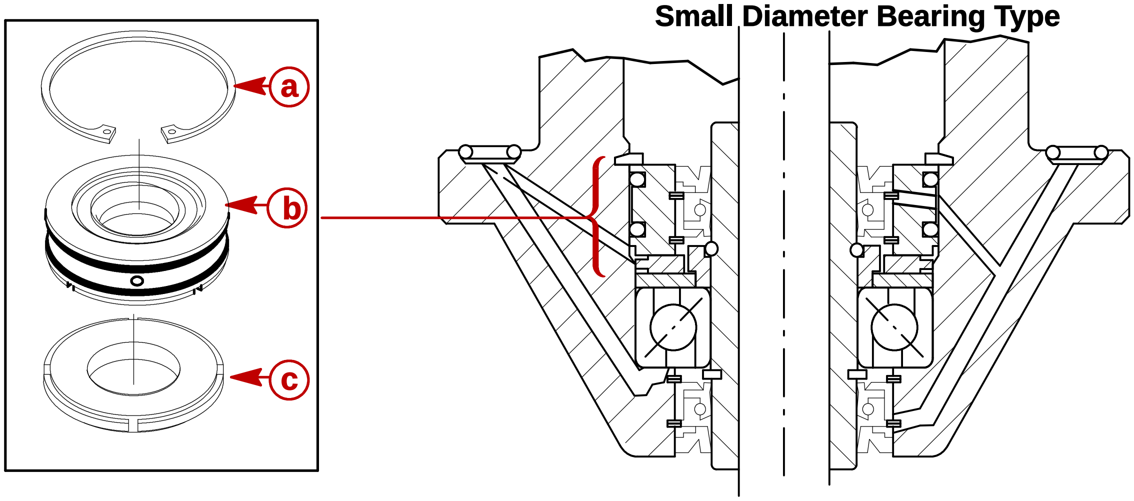
a - Bearing Carrier
b - Drive Shaft

Installing Upper Seal Housing

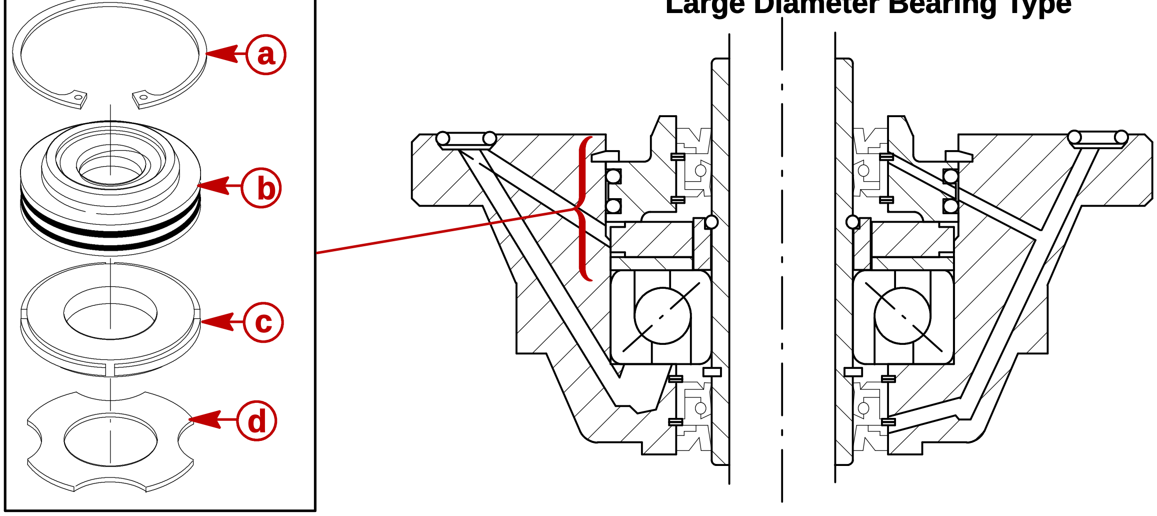
Single Bearing System

1. Grease the upper O-ring seals and inside bore of the bearing carrier to ease entry of the seal housing.
2. <u>Large Diameter Bearing Type Only</u>: Install thrust washer (d) – [GRAY teflon coating side of thrust washer FACES ball bearing] – on top of bearing.
3. Install spacer on top of the thrust washer.
4. Install the upper seal housing (b) being careful not to damage the O-ring seals as they pass the snap ring groove. Only finger pressure should be necessary to push in the housing.
5. Install the beveled snap ring (a), <u>beveled side facing up</u> into the ring groove. <u>Make sure the snap ring is fully seated into groove.</u>
6. Install the bearing carrier into the jet drive and fill with grease, using a grease gun . If using a hand lever gun, pump very slowly so as to not build up internal grease pressure and damage the seals or housing.

Small Diameter Bearing Type



Large Diameter Bearing Type



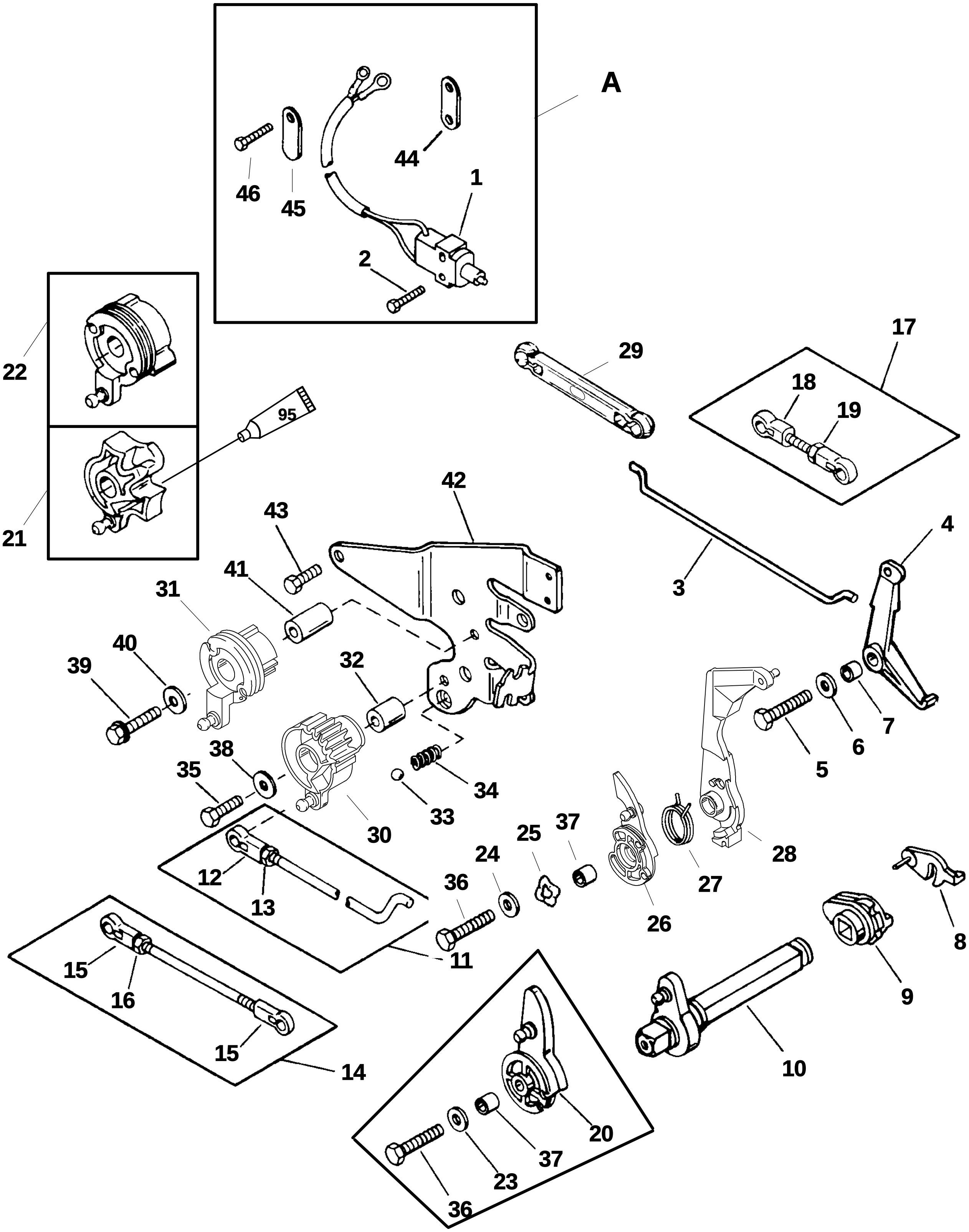
CONTROLS

Section 7A - Throttle/Shift Linkage

Table of Contents

7
A

Throttle and Shift Linkage (Tiller Handle Shift)



95 2-4-C With Teflon (92-825407A12)

A=LOCAL ELECTRIC ONLY

Throttle and Shift Linkage (Tiller Handle Shift)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	SWITCH–interlock			
2	2	SCREW (M3.5x0.6x16 hex wsh)	20.0		2.3
3	1	LINK interlock			
4	1	LEVER–interlock control			
5	1	SCREW (M6x1x25 hex hd cap)	120		13.6
6	1	PLAIN WASHER (62x.255x.03)			
7	1	BUSHING			
8	1	LEVER–backplate			
9	1	LEVER–horizontal shift shaft (PORT)			
10	1	SHIFT SHAFT (HORIZONTAL)			
11	1	SHIFT LINK ASSEMBLY			
12	1	SOCKET			
13	1	NUT			
14	1	THROTTLE LINK ASSEMBLY			
15	2	SOCKET			
16	1	NUT			
17	1	LINK–spark adjustment **S/N**			
18	2	SOCKET **USA-0G437999 & BELOW**			
19	1	NUT **BEL- 9926999 & BELOW**			
20	1	THROTTLE CAM ASSEMBLY **S/#**			
21	1	LEVER–gear shift **USA–0G286099 & BELOW**			
22	1	PRIMARY LEVER **BEL–9881099 & BELOW**			
23	1	WASHER (.62x.255x.03) (Use w/Ref #20)			
20	1	THROTTLE CAM ASSEMBLY **S/N**			
21	1	LEVER–gear shift **USA–0G286100 thru 0G437999**			
22	1	PRIMARY LEVER **BEL–9881100 thru 9926999**			
23	1	WASHER (Use w/Ref #20)			
24	1	WASHER			
25	1	WAVE WASHER			
26	1	THROTTLE CAM **S/N**			
27	1	SPRING **USA-0G438000 & UP**			
28	1	SPARK ARM **BEL-9927000 & UP**			
29	1	TIMING LINK			
30	1	SECONDARY GEAR			
31	1	PRIMARY GEAR			
32	1	BUSHING			
33	1	BALL–detent			
34	1	SPRING			
35	1	SCREW (M6x1x20 hex hd cap)	120		13.6
36	1	SCREW (M6x1x25 hex hd cap)	120		13.6
37	1	BUSHING			
38	1	WASHER (.62x.255x.03)			
39	1	SCREW (M6x1x30)	120		13.6
40	1	WASHER (.62x.255x.03)			
41	1	BUSHING			
42	1	CONTROL PLATFORM			
43	3	SCREW (M5x1x16 hex washer hd)	120		13.6
44	1	PLATE			
45	1	STRAP			
46	1	SCREW			

Control Cables (Tiller Handle Shift)

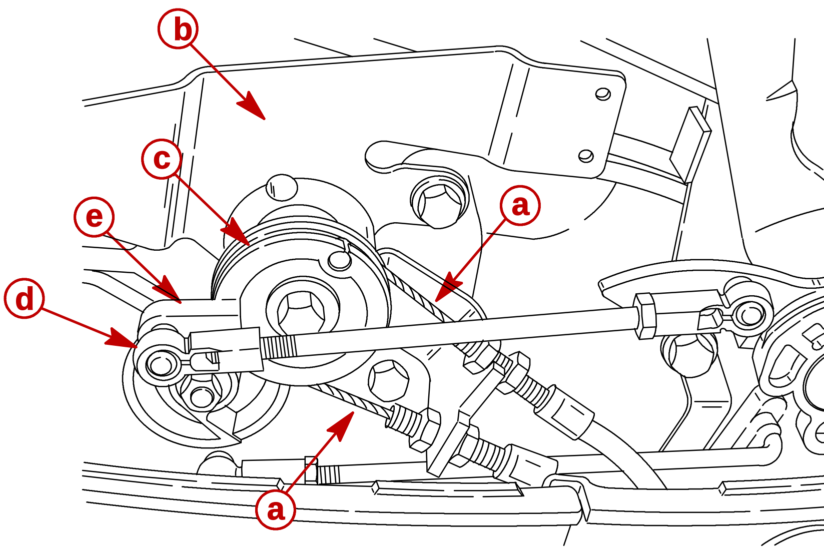
Removal/Installation

Refer to **Section 7B** for removal and installation instructions

Control Platform

Removal/Disassembly

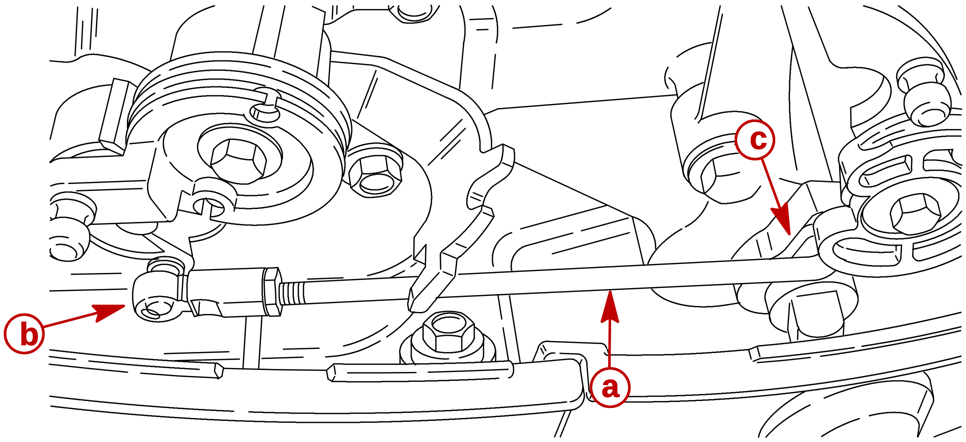
1. Disconnect control cables from anchor bracket and pulley as outlined in **Section 7B**.
2. Disconnect throttle link rod from ball joint of primary throttle lever.



57031

a - Cables
b - Bracket
c - Pulley
d - Link Rod
e - Throttle Lever

3. Disconnect shift link rod from ball joint of gear shift lever.

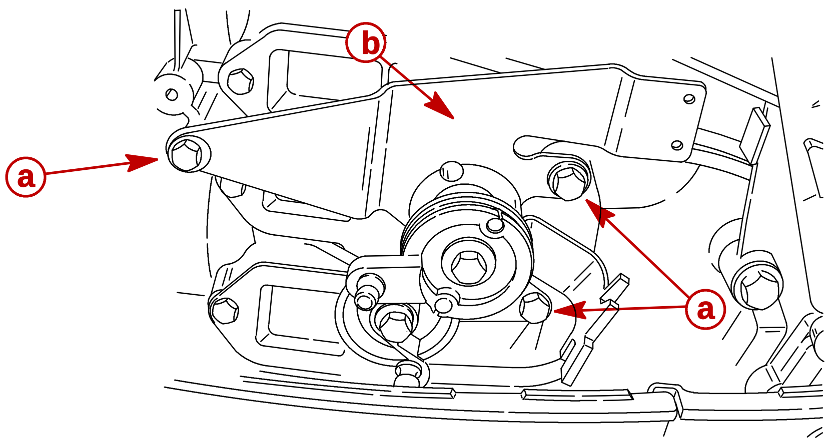


57033

a - Shift Link Rod
b - Gear Shift Lever
c - Shift Lever

4. Remove 3 bolts and control platform.

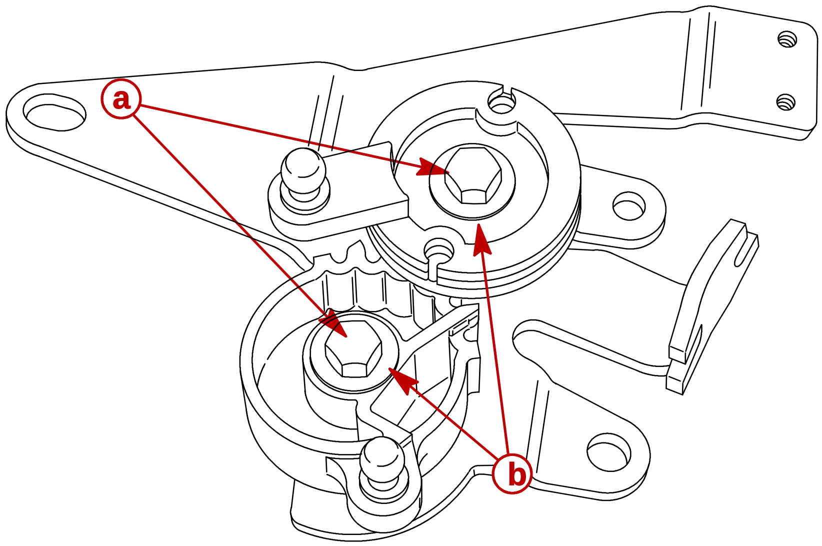
–



57034

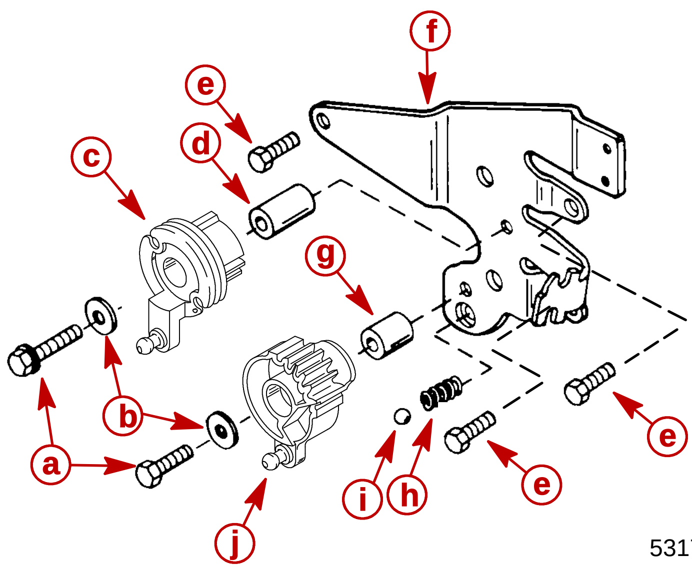
a - Bolts
b - Control Platform

5. Remove nuts and flat washers.



a - Nuts
b - Flat Washers

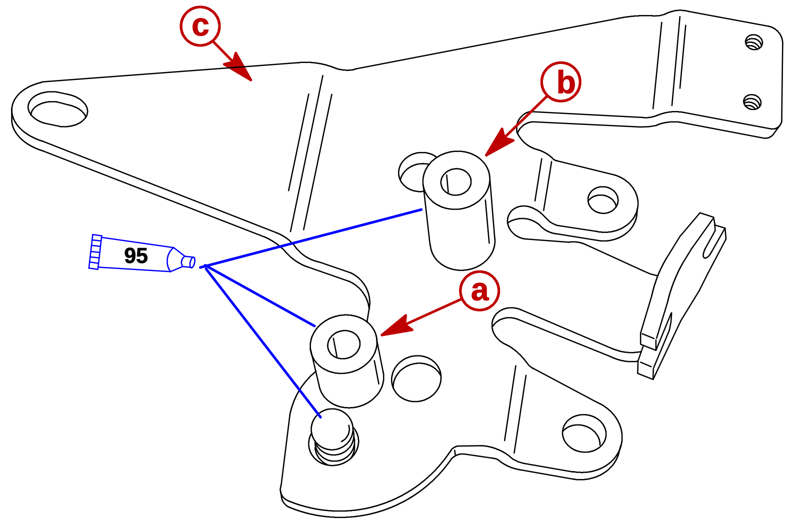
6. Disassemble control platform.



a - Bolts (2) – Torque to 120 lb. in. (13.6 N·m)
b - Flatwashers (2)
c - Primary Gear
d - Bushing (Long)
e - Mount Bolts – Torque to 120 lb. in. (13.6 N·m)
f - Control Platform
g - Bushing (Short)
h - Detent Spring
i - Detent Ball
j - Secondary Gear

Reassembly/Installation

1. Install short bushing and long bushing on control platform.
2. Install detent spring and detent ball into recess of control platform.
3. Lubricate bushings and area of platform traveled by gears with 2-4-C w/Teflon.

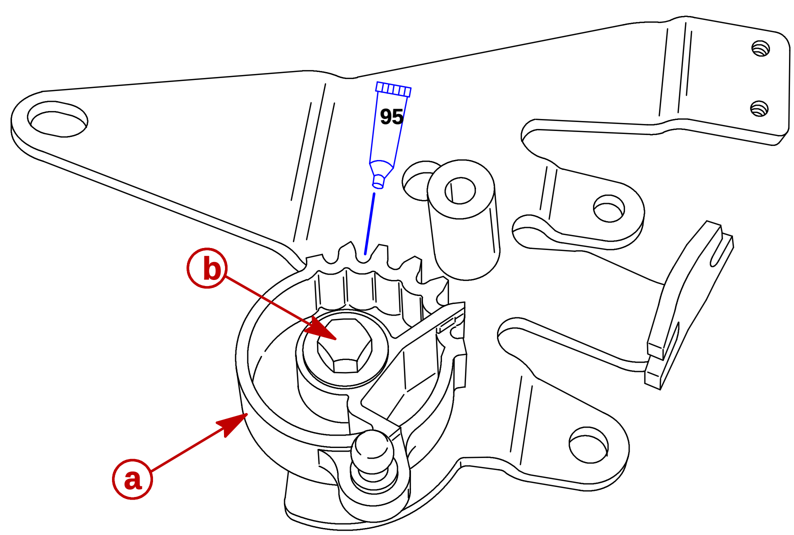


57038

95 2-4-C With Teflon (92-825407A12)

a - Short Bushing
b - Long Bushing
c - Platform

4. Install secondary gear over short bushing and detent ball and spring as shown.
5. Secure secondary gear with bolt and flat washer. Torque bolt to 120 lb. in. (13.6 N·m).
6. Lubricate gear teeth with 2-4-C w/Teflon.

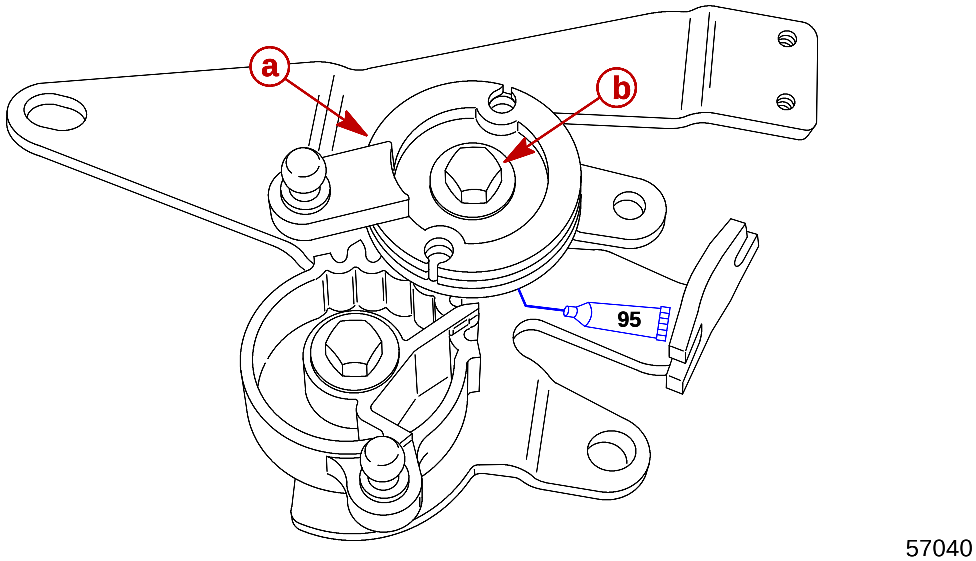


57039

95 2-4-C With Teflon (92-825407A12)

a - Secondary Gear
b - Bolt and Flat Washer – Torque to 120 lb. in. (13.6 N·m)

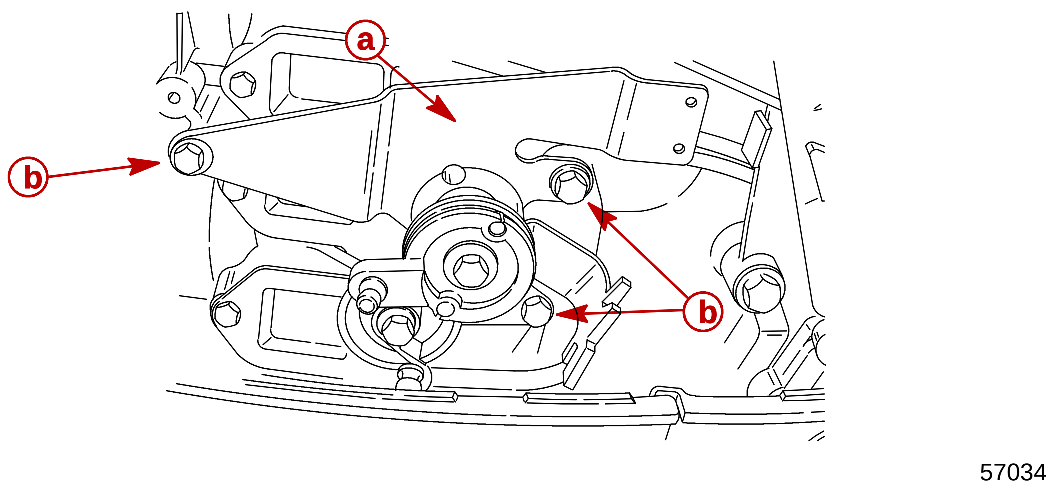
7. Install primary gear over long bushing as shown.
8. Secure primary gear with bolt and flat washer. Torque bolt to 120 lb. in. (13.6 N·m).
9. Lubricate gear teeth with 2-4-C w/Teflon.



95 2-4-C With Teflon (92-825407A12)

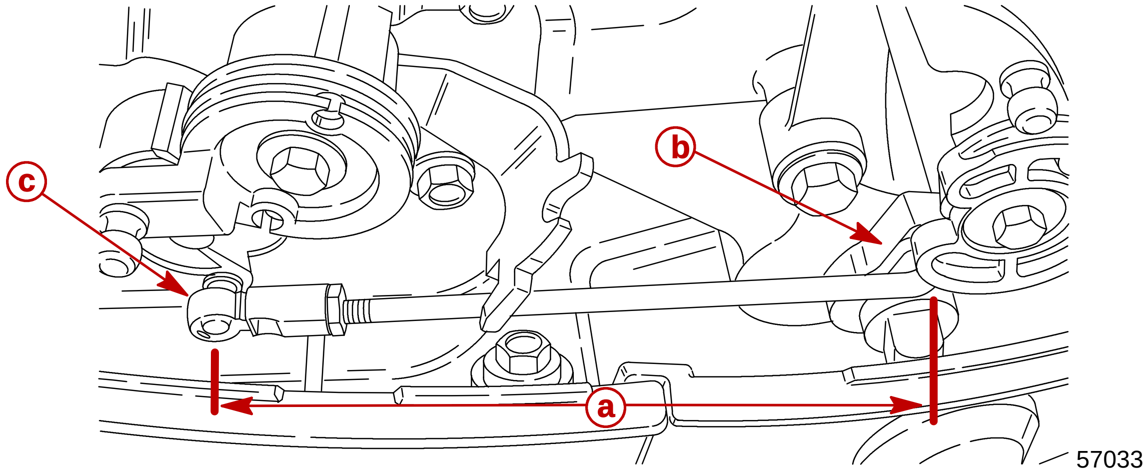
a - Primary Gear
b - Bolt and Flat Washer – Torque to 120 lb. in. (13.6 N·m)

10. Secure assembled control platform onto cylinder block using 3 bolts. Torque bolts to 120 lb. in. (13.6 N·m).



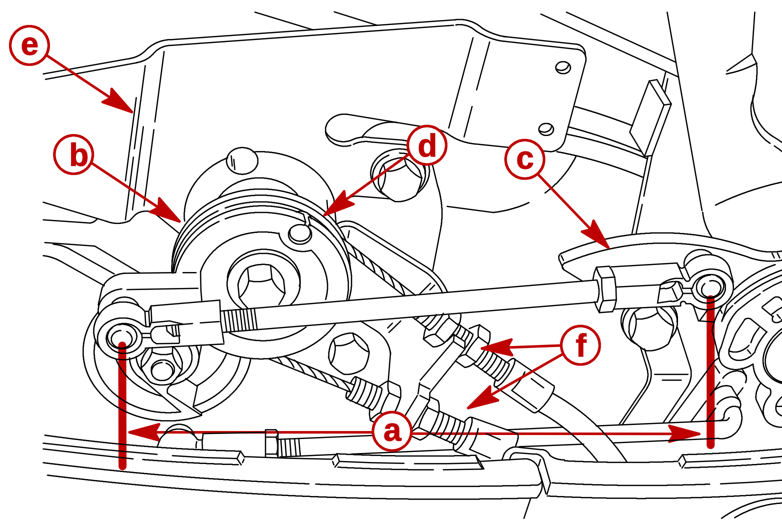
a - Platform
b - Bolts – Torque to 120 lb. in. (13.6 N·m)

11. Adjust shift link rod to a length of 5-1/2 in. (13.9 cm) as measured between ball joint centerlines.
12. Connect shift link rod between joints of secondary lever and shift shaft lever.



a - Shift Link Rod – Adjust to length of 5-1/2 in. (13.9 cm)
b - Shift Shaft Lever
c - Secondary Lever

13. Adjust throttle link rod to a length of 5-1/4 in. (13.3 cm) as measured between ball joint centerlines.
14. Connect throttle link rod between ball joints of primary gear and throttle cam.

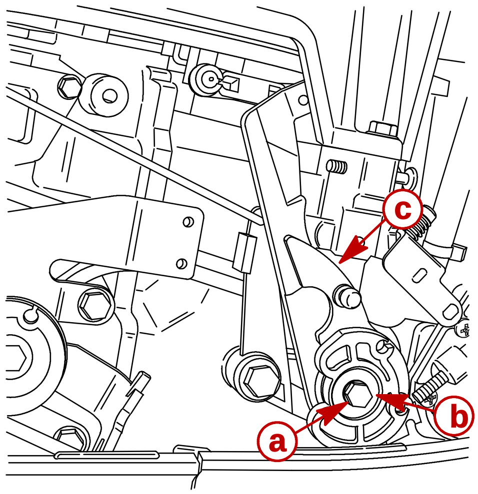


a - Throttle Link Rod – Adjust to length of 5-1/4 in. (13.3 cm)
b - Primary Gear
c - Throttle Cam
d - Pulley
e - Anchor Bracket
f - Control Cables

Throttle Cam/Control Lever

Removal

1. Refer to **Section 7B** for removal of throttle cables.
2. Remove bolt and flat washer securing cam/lever to powerhead.



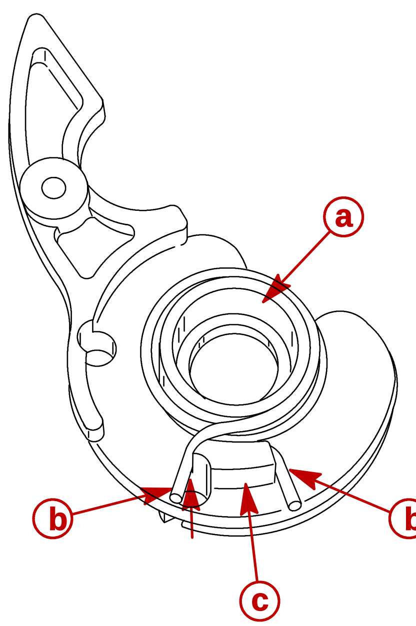
57041

a - Bolt
b - Washer
c - Cam/Lever

Throttle Cam/Control Lever

Reassembly

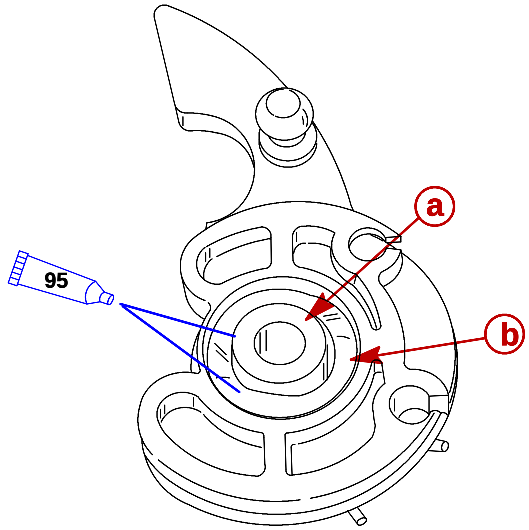
1. Position spring over hub of throttle cam. Spring ends must straddle tab.



57042

a - Hub
b - Spring Ends
c - Tab

2. Lubricate bushing with 2-4-C w/Teflon and install bushing and wave washer.



95 2-4-C With Teflon (92-825407A12)

57050

a - Bushing
b - Wave Washer

3. Install control lever onto throttle cam assembly so that tab of control lever is positioned between ends of spring.

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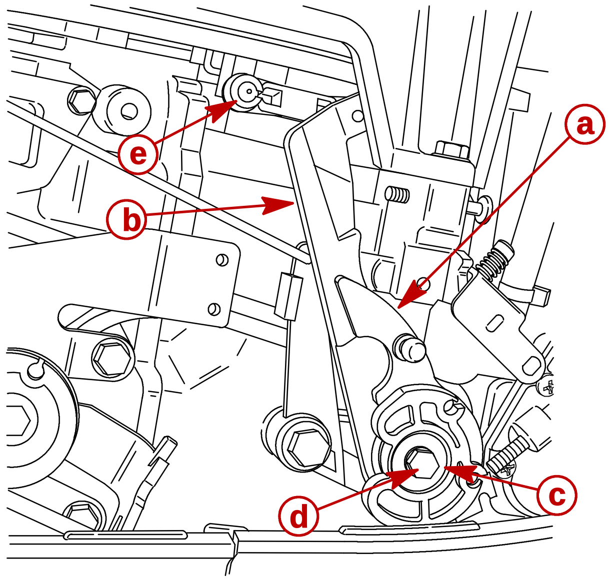
a - Control Lever
b - Tab
c - Ends of Spring

Installation

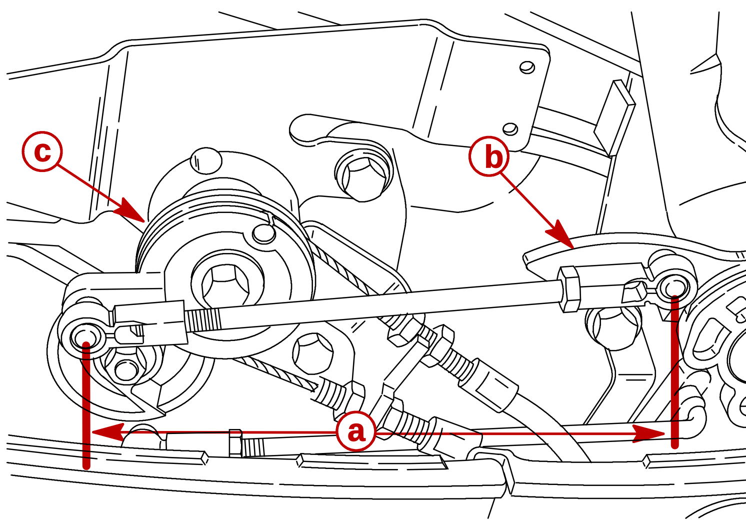
1. Secure throttle cam/control lever assembly onto mounting boss of crankcase cover with bolt. Torque bolt to 120 lb. in. (13.6 N·m).
2. Connect timing link between ball joints of control lever and trigger assembly.



57041

a - Throttle Cam
b - Control Lever
c - Flat Washer
d - Bolt – Torque bolt to 120 lb. in. (13.6 N·m)
e - Timing Link

3. Adjust throttle link rod to a length of 5-1/4 in. (13.3cm) as measured between ball joint center lines.
4. Connect throttle link rod between ball joints of throttle cam and primary throttle lever.



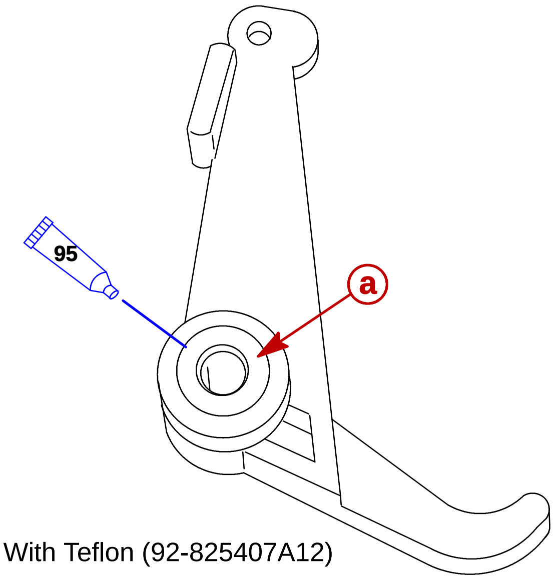
57031

a - Throttle Link Rod – Adjust to a length of 5-1/4 in. (13.3cm)
b - Throttle Cam
c - Primary Gear

Neutral Interlock Control Lever

Reassembly/Installation

1. Lubricate bushing with 2-4-C w/Teflon and install bushing.

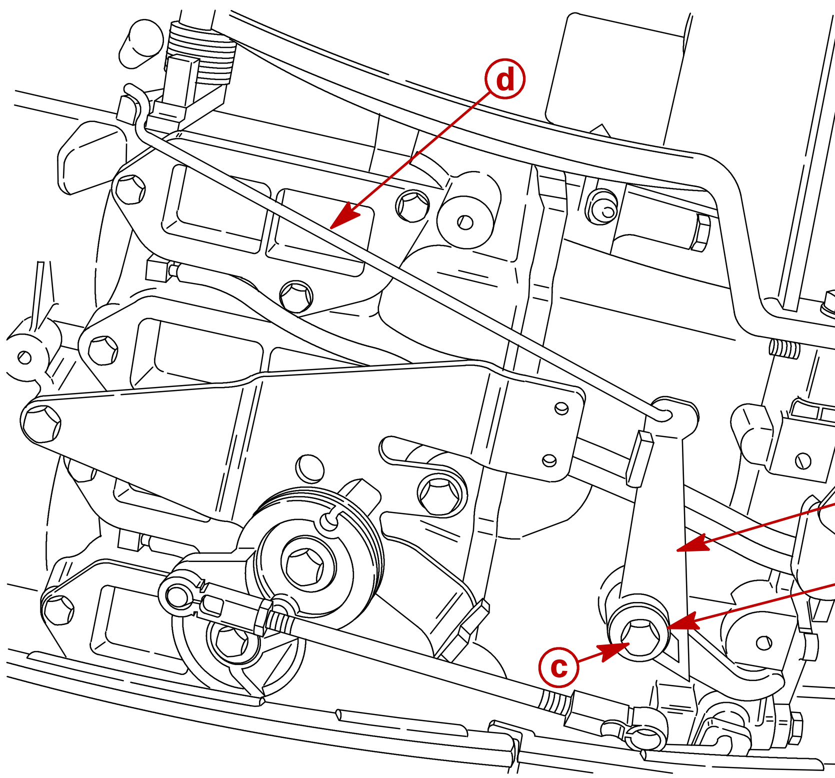


95 2-4-C With Teflon (92-825407A12)

57045

a - Bushing

2. Secure interlock lever components with bolt onto mounting boss of crankcase cover.



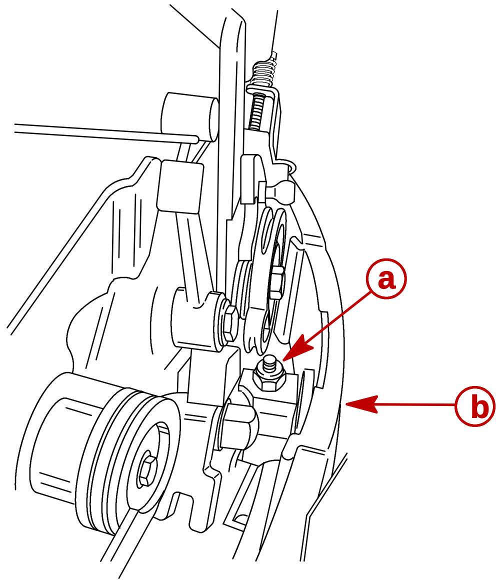
57044

a - Interlock lever
b - Flat washer
c - Bolt – Torque to 120 lb. in. (13.6 N·m)
d - Neutral Interlock Wire

Horizontal Shift Shaft

Removal

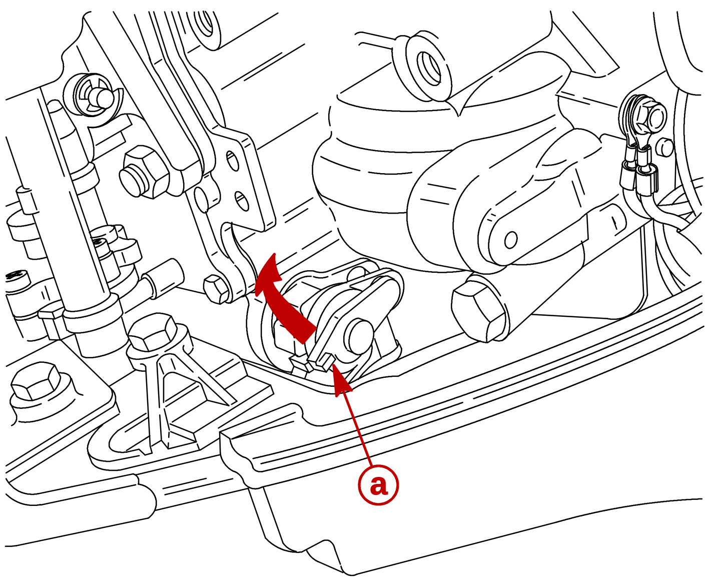
1. Remove nut securing access cover to port side of bottom cowl. Remove cover.



57035

a - Nut
b - Access Cover

2. Lift up and remove lever securing horizontal shift shaft.



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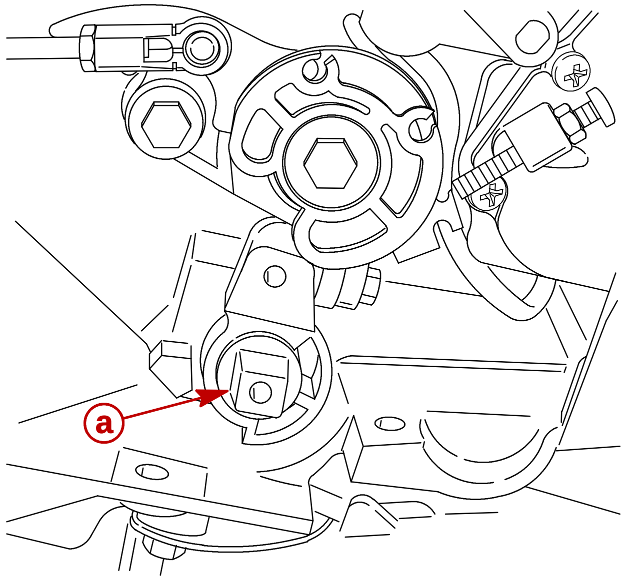
a - Lever

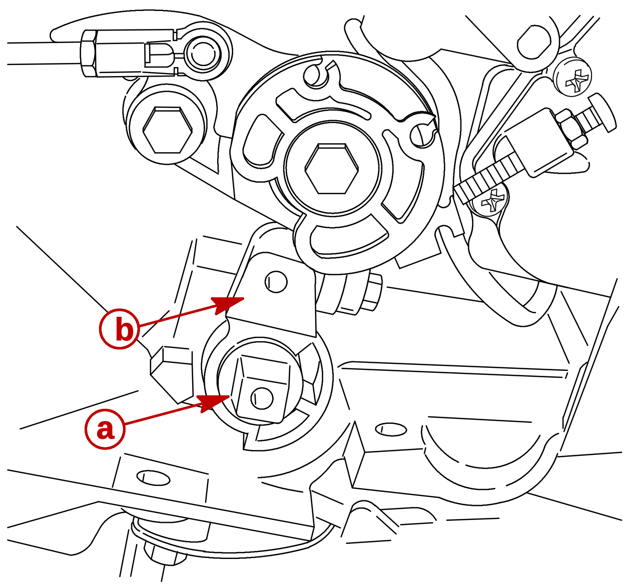
3. Pull out and remove horizontal shift shaft.



a - Horizontal Shift Shaft

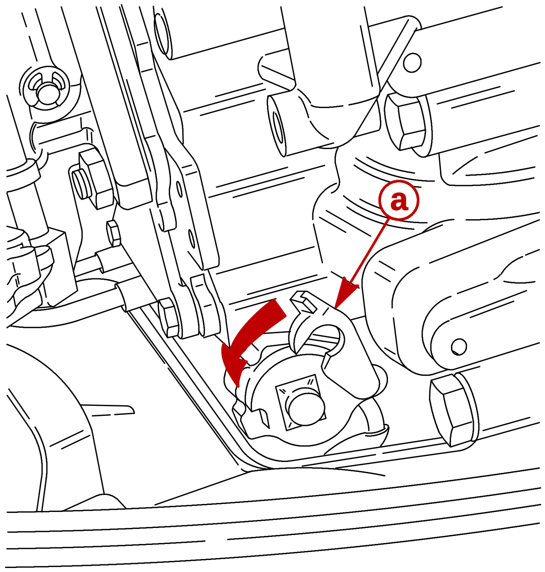
Installation

1. Install horizontal shift shaft/shift lever assembly into opening in STARBOARD side of crankcase cover.



a - Horizontal Shift Shaft
b - Shift Lever

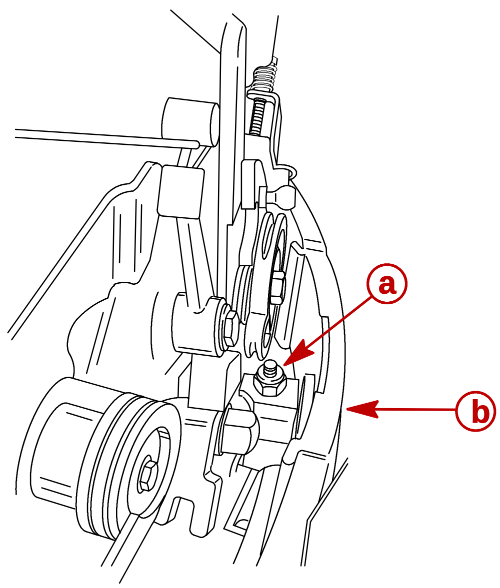
2. Secure end of shift shaft to yoke of horizontal shift shaft with lever



57047

a - Lever

3. Reinstall access cover and secure with nut and bolt. Torque nut to 50 lb. in. (5.6 N·m).



57035

a - Access Cover
b - Nut – Torque to 50 lb. in. (5.6 N·m)

4. Refer to **Control Platform/Throttle Cam/Control Lever** previous and reinstall platform, shift link and throttle cam.

CONTROLS

Section 7B - Tiller Handle

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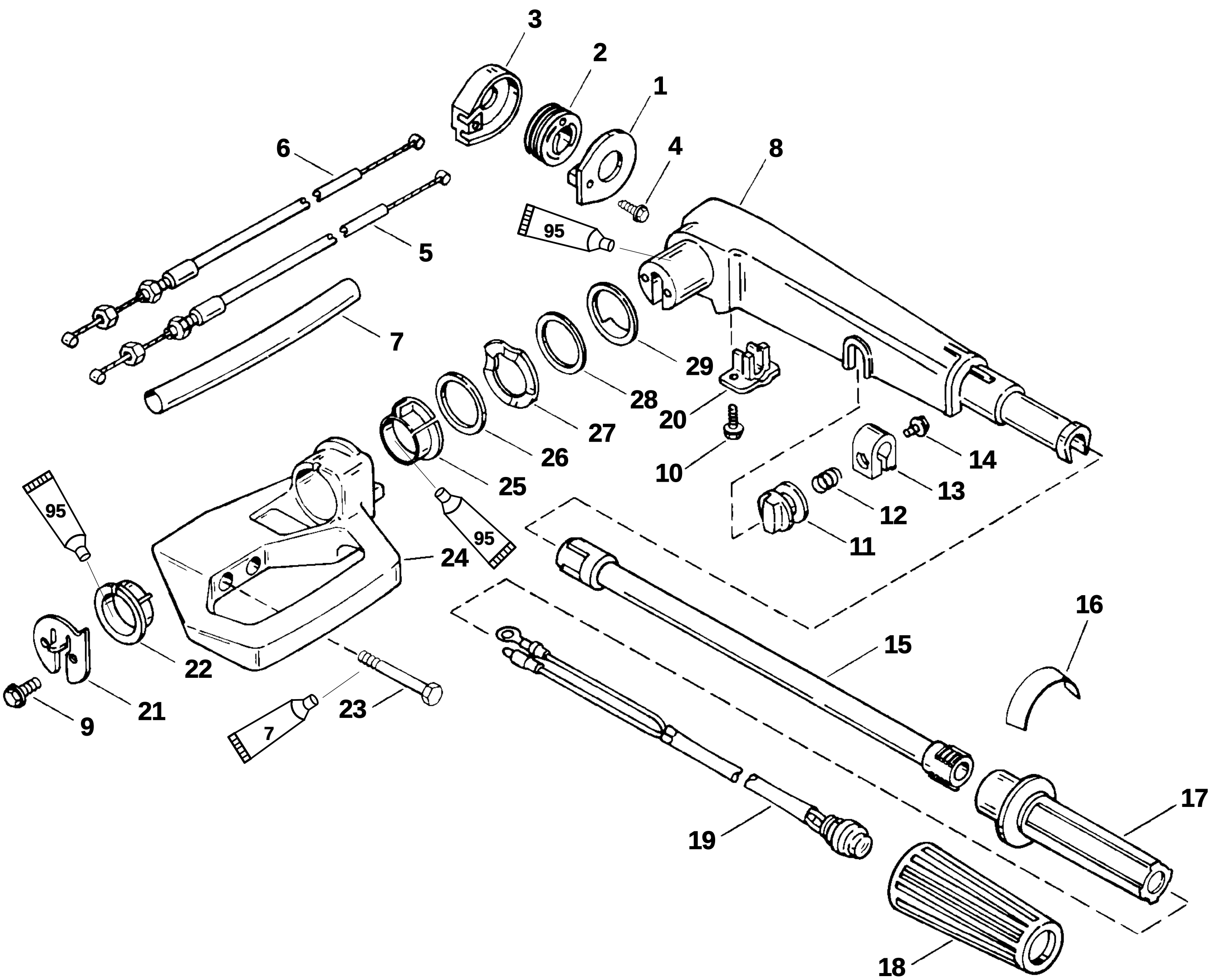
B

Tiller Handle Assembly



7 Loctite 271 (92-809820)

95 2-4-C With Teflon (92-825407A12)

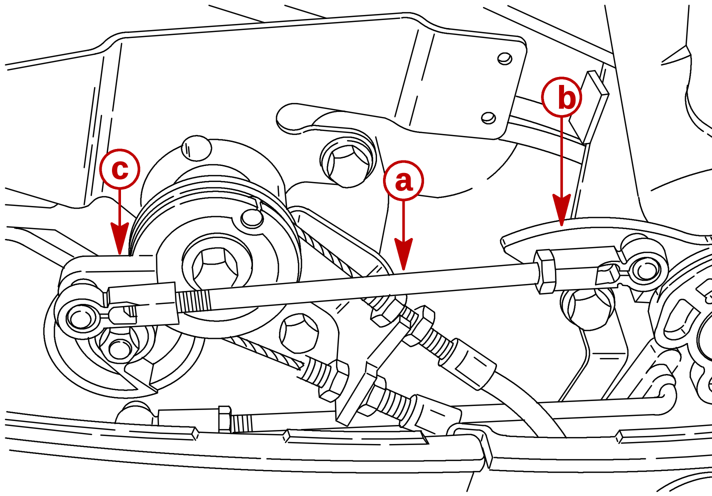
Tiller Handle Assembly

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
–	1	TILLER HANDLE **(BLACK)** **TILLER HANDLE**			
–	1	TILLER HANDLE **(GRAY)** **SHIFT**			
–	1	TILLER HANDLE **(BLACK)** **SIDE SHIFT**			
–	1	TILLER HANDLE **(GRAY)**			
1	1	COVER KIT **(TILLER HANDLE SHIFT)**			
	1	COVER KIT **(SIDE SHIFT)**			
2	1	PULLEY			
3	1	CASE			
4	1	SCREW (#10-16x1/2 IN.)	Drive Tight		
5	1	THROTTLE CABLE **(TILLER HANDLE SHIFT)**			
	1	THROTTLE CABLE **(SIDE SHIFT)**			
6	1	THROTTLE CABLE **(TILLER HANDLE SHIFT)**			
	1	THROTTLE CABLE **(SIDE SHIFT)**			
7	1	SLEEVE–throttle cable			
8	1	ARM–steering handle **(BLACK)**			
	1	ARM–steering handle **(GRAY)**			
9	2	SCREW **(M5x1x16)**	80		9.0
	2	SCREW **(M6x1x20)**			
10	1	SCREW (M5x.5x16)	50		5.6
11	1	KNOB–throttle friction	As Required		
12	1	SPRING			
13	1	LOCK–throttle friction			
14	1	SCREW (M6x1x25)			
15	1	TILLER TUBE			
16	1	DECAL **(TILLER HANDLE SHIFT)**			
	1	DECAL **(SIDE SHIFT)**			
17	1	THROTTLE HANDLE **(TILLER HANDLE SHIFT)**			
	1	THROTTLE HANDLE **(SIDE SHIFT)**			
18	1	GRIP–throttle handle			
19	1	STOP SWITCH			
20	1	RETAINER			
21	1	PLATE–tiller handle **(Use with 6MM screw REF. #9)**			
	1	PLATE–tiller handle **(Use with 5MM screw REF. #9)**			
22	1	BUSHING			
23	2	SCREW (M10x1.5x80)	390	32.5	44.1
24	1	BRACKET **(BLACK)**			
	1	BRACKET **(GRAY)**			
25	1	BUSHING			
26	1	WASHER			
27	1	WAVE WASHER			
28	1	WASHER			
29	1	WASHER			

Control Cables

Removal

1. Place tiller handle twist grip in NEUTRAL position.
2. Remove throttle link rod from throttle cam and primary throttle lever.

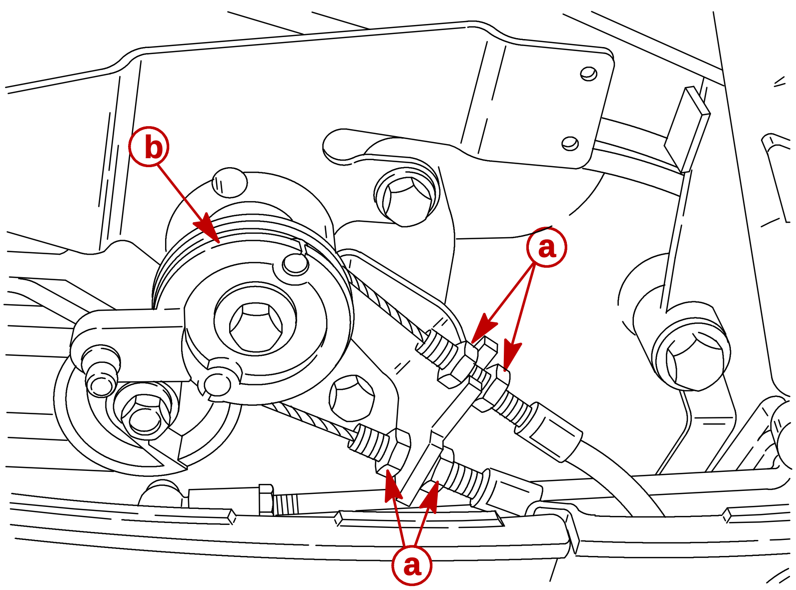


57031

a - Link Rod
b - Throttle Cam
c - Primary Throttle Lever

3. Loosen jam nuts which secure control cables to anchor bracket.
4. Unwrap and remove control cables from pulley of primary gear.

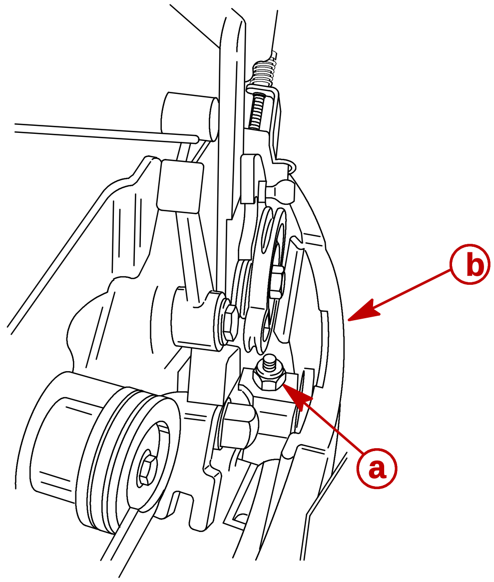
NOTE: *If not replacing control cables, mark top cable with a piece of tape to aid in reassembly.*



57032

a - Jam Nuts
b - Primary Gear

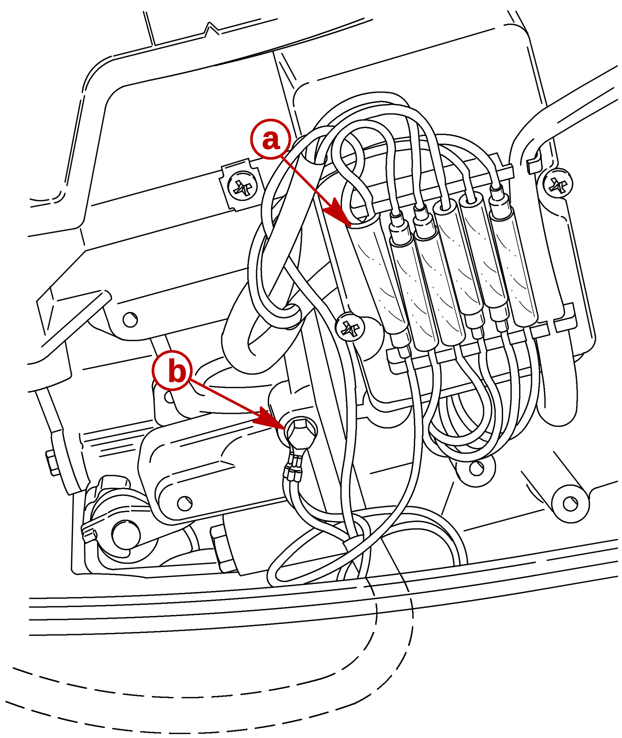
5. Remove nut securing access cover and remove cover



57035

a - Nut
b - Access Cover

6. Disconnect stop button wires – BLACK/YELLOW and BLACK.



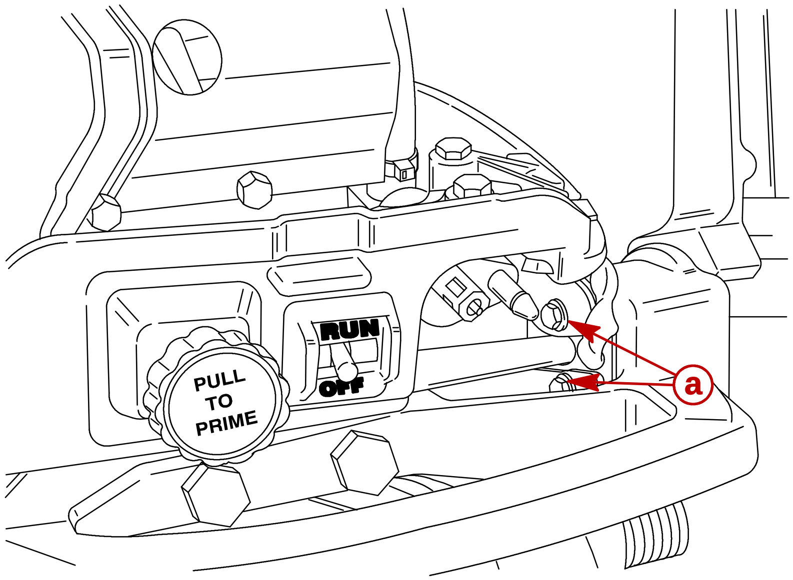
57036

a - BLACK/YELLOW
b - BLACK

Tiller Handle Removal/Disassembly

Removal

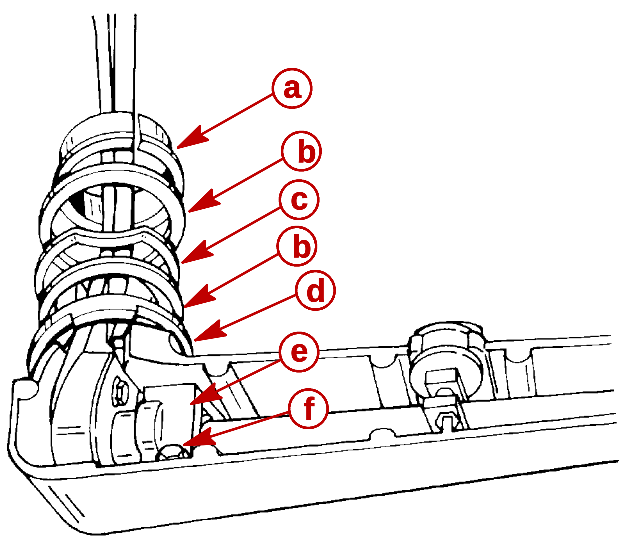
1. Remove 2 bolts securing tiller handle to anchor bracket and remove tiller handle assembly.



57037

a - Bolts

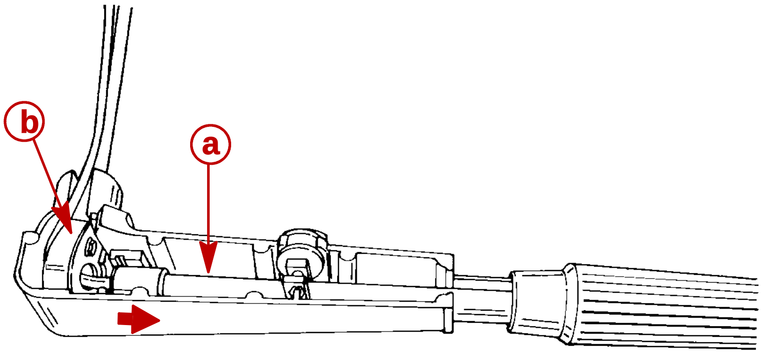
2. Remove bushing, flatwashers (2). wave washer and tiller handle washer. Remove retainer and bolt.



53248

a - Bushing
b - Flat Washer (2)
c - Wave Washer
d - Tiller Handle Washer
e - Retainer
f - Bolt

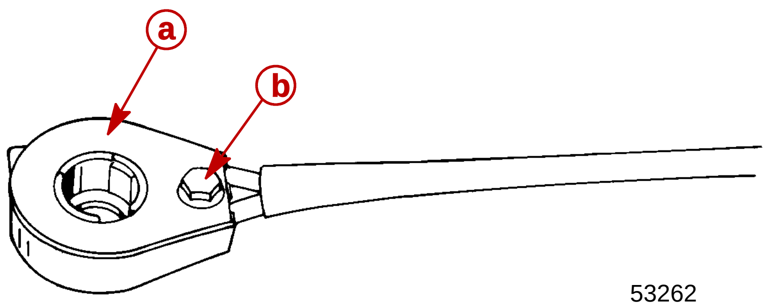
3. Slide tiller tube out of pulley case.



53256

a - Tiller Tube
b - Pulley Case

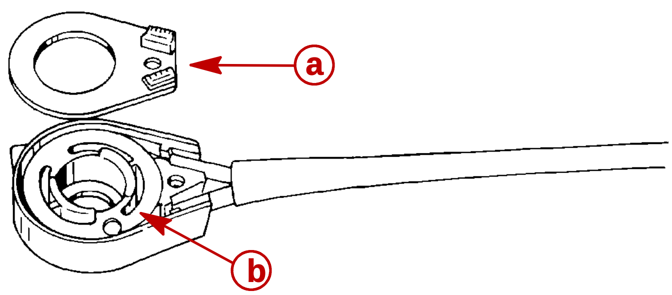
4. Remove pulley case assembly from tiller handle and remove cover bolt.



53262

a - Pulley Case Assembly
b - Cover Bolt

5. Remove cover and lift pulley assembly from case. Replace cables as required.

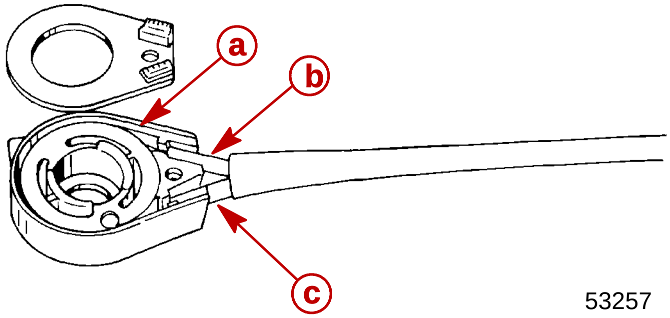


53257

a - Cover
b - Pulley Assembly

Installation

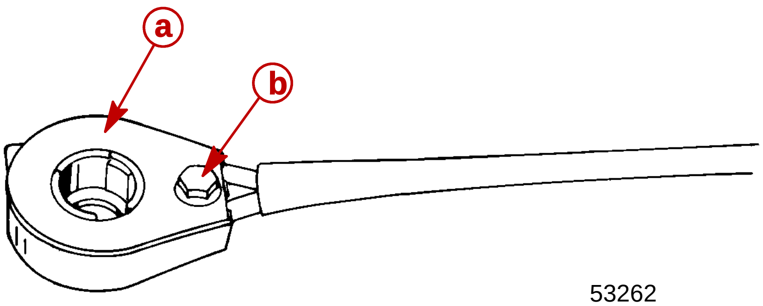
1. Wrap cables around pulley. Top cable wraps and locks in top groove. Bottom cable wraps and locks in bottom groove.
2. Place pulley and cable assembly into pulley case.



53257

a - Pulley
b - Top Cable
c - Bottom Cable

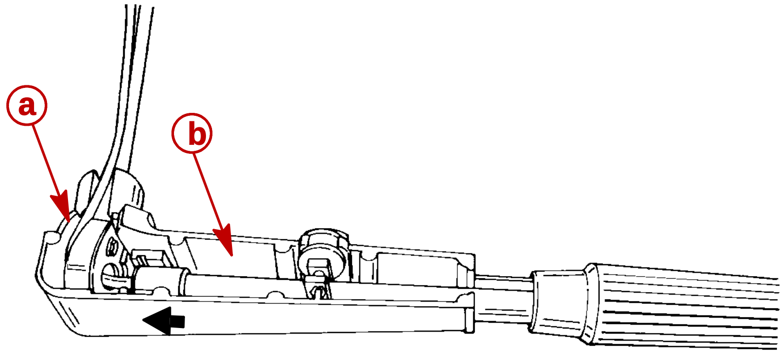
3. Install pulley cover and secure cover with bolt.



53262

a - Cover
b - Bolt (Drive Tight)

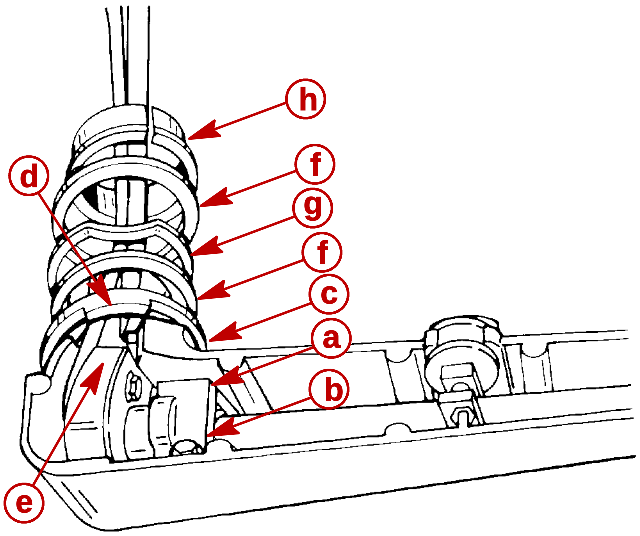
4. Install pulley assembly into tiller handle and slide tiller tube into pulley.



53256

a - Pulley Assembly
b - Tiller Tube

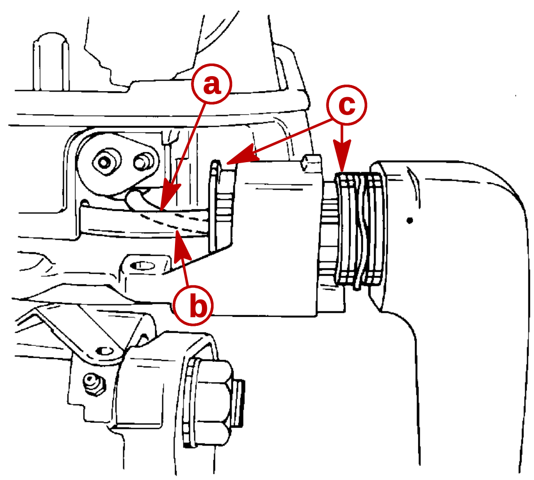
5. Secure tiller tube in handle with retainer and bolt. Torque bolt to 50 lb. in. (5.6 N·m).
6. Install tiller washer (tab aligns with slot in handle), plain washer, wave washer, plain washer and flanged bushing over cable/harness assembly.



53248

a - Retainer
b - Bolt – Torque to 50 lb. in. (5.6 N·m)
c - Tiller Washer
d - Tab
e - Slot
f - Plain Washer
g - Wave Washer
h - Flanged Bushing

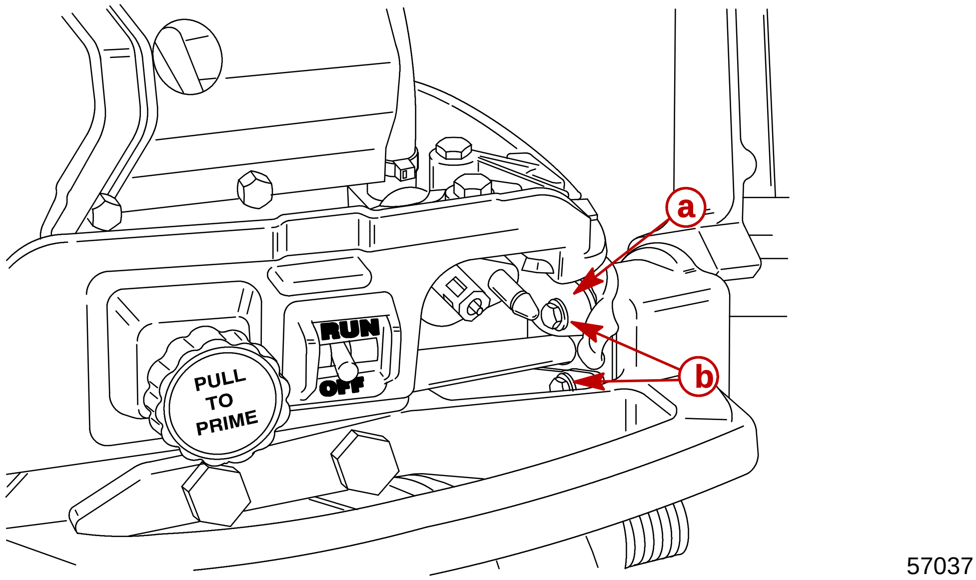
7. Slide tiller handle assembly into anchor bracket.
8. Route stop button harness through fuel connector opening in bottom cowl.
9. Route control cables through opening in bottom cowl.
10. Align tabs of inner and outer flanged bushings with slots in anchor bracket.



53169

a - Stop Button Harness
b - Control Cables
c - Tabs

11. Pull on cable ends to remove slack and secure tiller handle to anchor bracket with plate and 2 bolts. Torque bolts to 80 lb. in. (9.0 N·m).

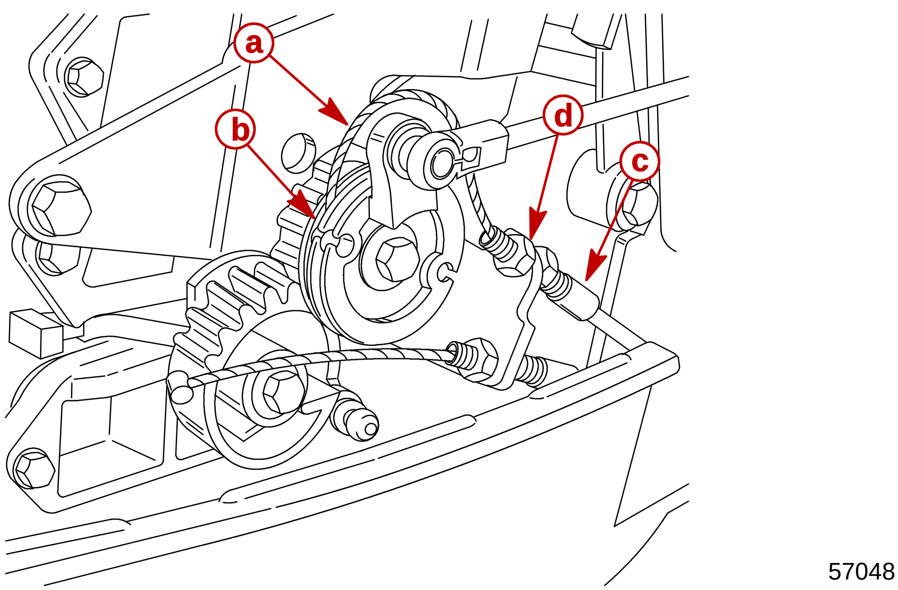


a - Plate
b - Bolts – Torque to 80 lb. in. (9.0 N·m)

Control Cables

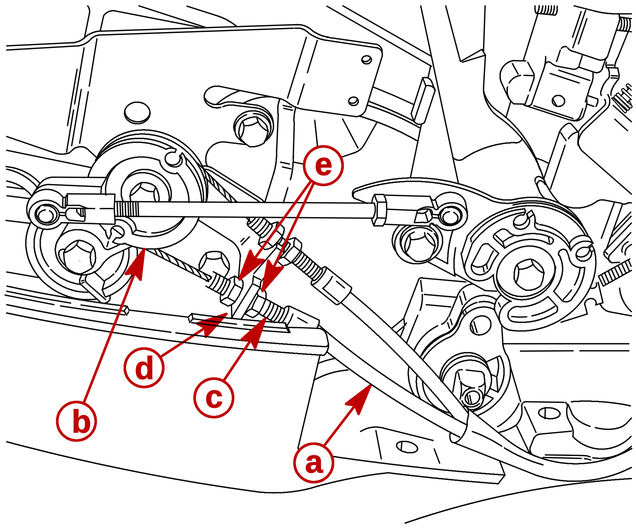
Installation

1. Rotate tiller handle twist grip to REVERSE gear position.
2. Route extended cable over top of primary gear pulley and secure cable into inner groove of pulley. Place cable jacket into top notch of cable anchor bracket.



a - Extended Cable
b - Inner Groove
c - Cable Jacket
d - Top Notch

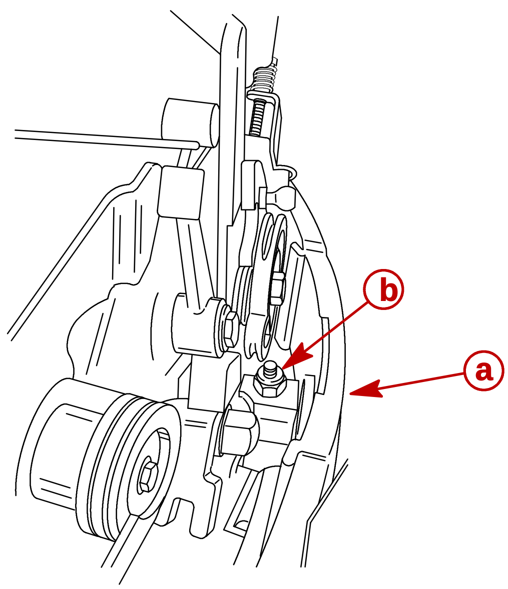
3. Rotate tiller handle to FORWARD gear position.
4. Route remaining cable below primary gear pulley and secure cable into outer groove of pulley. Place cable jacket into lower notch of cable anchor bracket.
5. Rotate tiller handle twist grip to NEUTRAL.
6. Rotate tiller handle twist grip to SLOW position.
7. Adjust jam nuts to remove slack from throttle cables while allowing full travel of throttle linkage/carburetor throttle shutter.



57049

a - Cable
b - Outer Groove
c - Cable Jacket
d - Lower Notch
e - Jam Nuts

8. Reinstall access cover. Secure cover with nut and bolt. Torque nut to 50 lb. in. (5.6 N·m).



57035

a - Access Cover
b - Nut – Torque to 50 lb. in. (5.6 N·m)

CONTROLS

Section 7C - Side Shift

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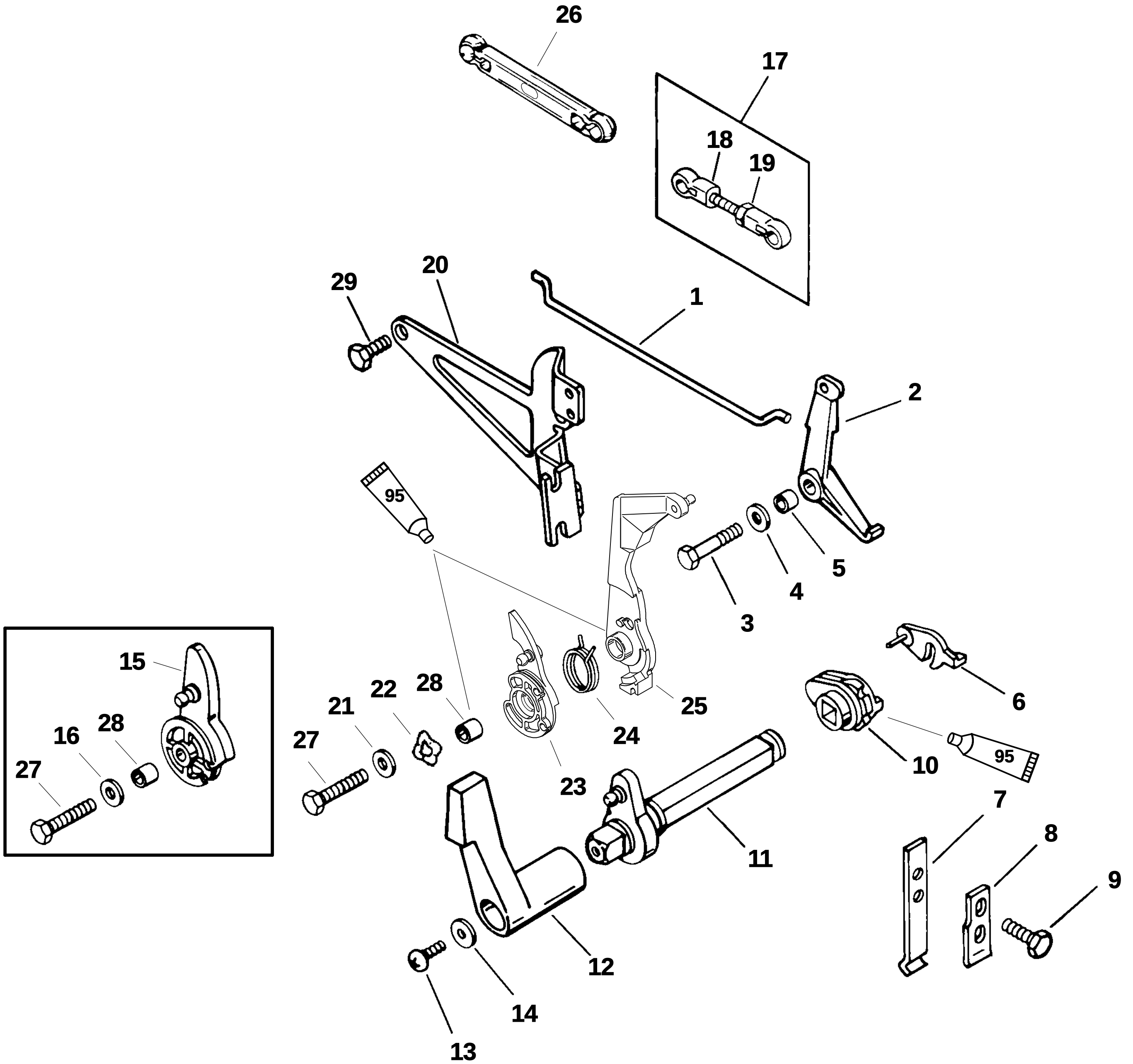
7
C

Throttle And Shift Linkage (Side Shift)



95 2-4-C With Teflon (92-825407A12)

Throttle and Shift Linkage (Side Shift)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	TORQUE lb. ft.	TORQUE N·m
1	1	LINK–interlock			
2	1	LEVER **(20/25) (JET 20 - S/N-G157846 & UP)**			
	1	LEVER **(**JET 20 - S/N-G157845 & BELOW**)**			
3	1	SCREW (M6x1x25)	120		13.6
4	1	WASHER			
5	1	BUSHING			
6	1	LEVER–backplate			
7	1	SPRING–detent **NOT USED ON JET 20**			
8	1	SPRING PLATE **S/N G157845 & BELOW**			
9	2	SCREW (M5x0.8x16)	40		4.5
10	1	LEVER–horizontal shift shaft (PORT)			
11	1	SHIFT SHAFT (HORIZONTAL)			
12	1	SHIFT HANDLE			
13	1	SCREW (M5 x 20)	50		5.6
14	1	WASHER			
15	1	THROTTLE CAM			
16	1	WASHER			
17	1	SPARK ADJUST LINK **20 JET**			
18	2	SOCKET			
19	1	NUT			
20	1	ANCHOR BRACKET–cable			
15	1	THROTTLE CAM **20/25**			
16	1	WASHER			
17	1	SPARK ADJUST LINK **S/N**			
18	2	SOCKET **USA-0G437999 & BELOW**			
19	1	NUT **BEL-9926999 & BELOW**			
20	1	ANCHOR BRACKET–cable			
	1	ANCHOR BRACKET–cable			
21	1	WASHER			
22	1	WAVE WASHER			
23	1	THROTTLE CAM **20/25 S/N**			
24	1	SPRING **USA-0G438000 & UP**			
25		SPARK ARM **BEL-9927000 & UP**			
26		TIMING LINK			
27	1	SCREW (M6x1x 25)	120		13.6
28	1	BUSHING			
29	3	SCREW (M5x1x16)	120		13.6

Throttle Cables
(Side Shift Models)

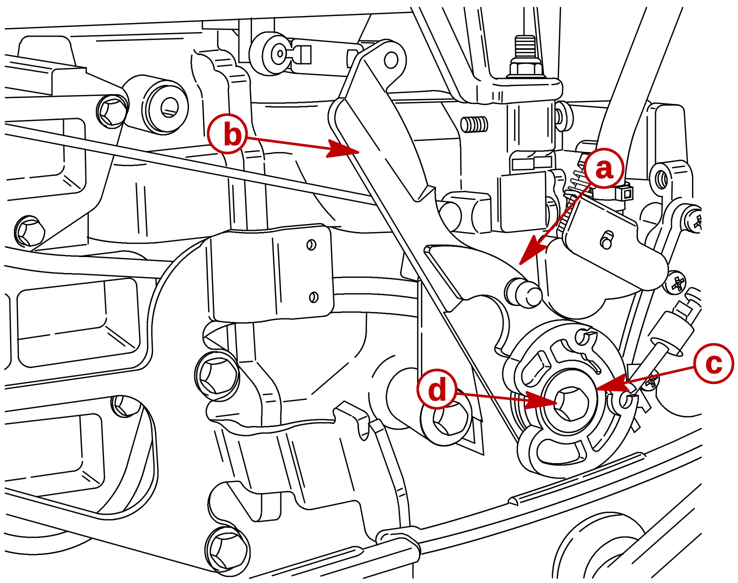
Removal/Installation

Refer to **Section 7B** for removal and installation instructions

Throttle Cam/Control Lever

Removal

1. Refer to **Section 7B** for removal of throttle cables.
2. Remove bolt and flat washer securing cam/lever to powerhead.



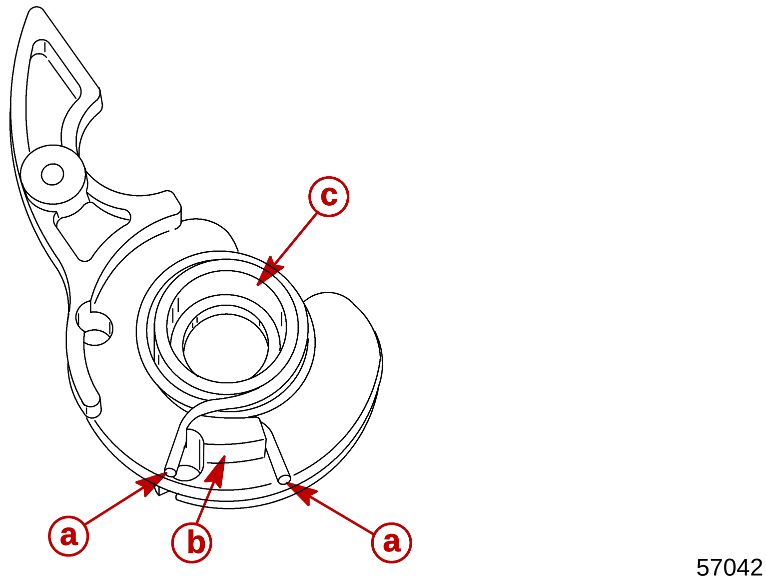
57065

a - Throttle Cam
b - Control Lever
c - Flat Washer
d - Bolt

Throttle Cam/Control Lever

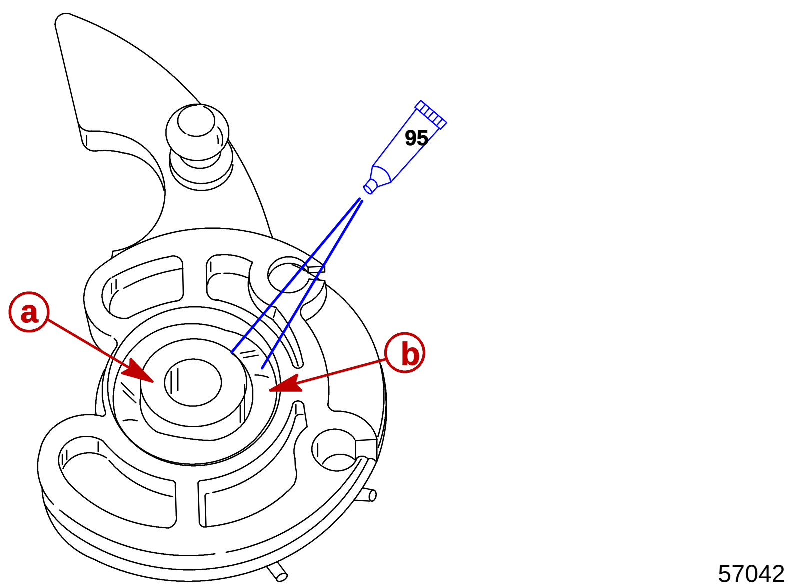
Reassembly

1. Position spring assembly over hub of throttle cam.



a - Inner Spring Ends
b - Hub
c - Tab

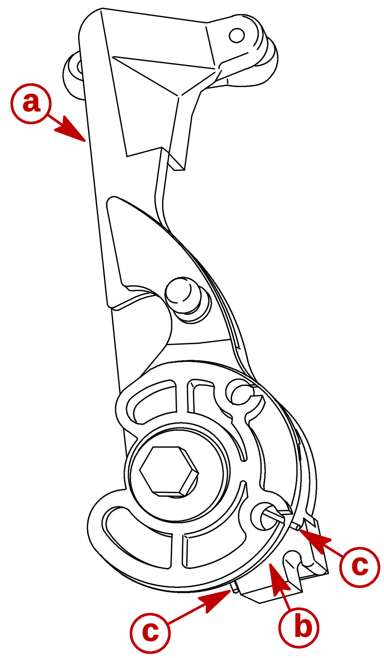
2. Lubricate bushing with 2-4-C w/Teflon and install bushing and wave washer.



95 2-4-C With Teflon (92-825407A12)

a - Bushing
b - Wave Washer

3. Install control lever onto throttle cam assembly so that tab of control lever is positioned between ends of inner spring.



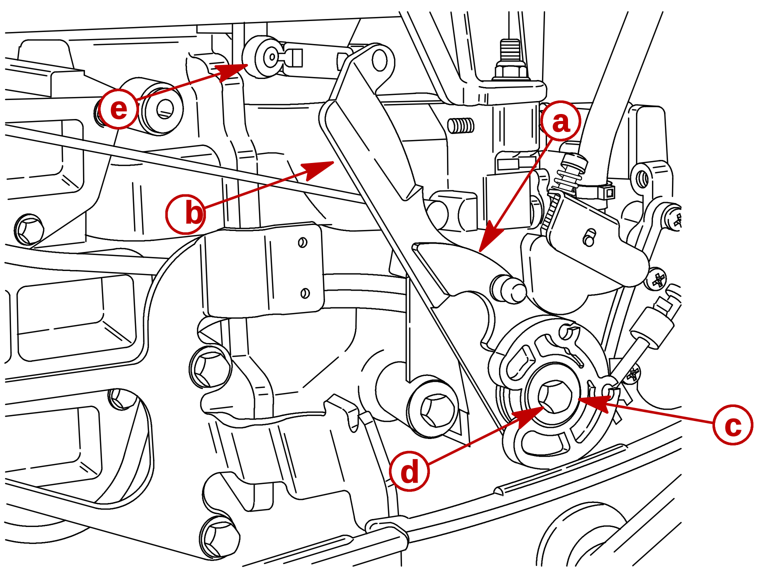
57043

a - Control Lever
b - Tab
c - Ends of Inner Spring

Installation

1. Secure throttle cam/control lever assembly onto mounting boss of crankcase cover with bolt. Torque bolt to 120 lb. in. (13.6 N·m).

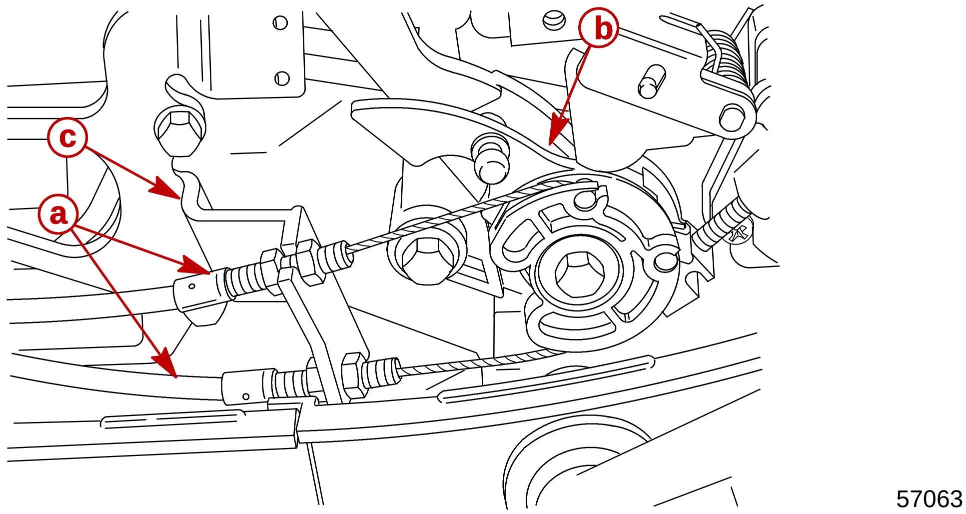
2. Connect timing link between ball joints of control lever and trigger assembly.



57065

a - Throttle Cam
b - Control Lever
c - Flat Washer
d - Bolt – Torque bolt to 120 lb. in. (13.6 N·m)
e - Timing Link

3. Connect throttle cables to throttle cam and throttle cable anchor bracket as outlined in "Throttle Cable" – "Installation", preceding.

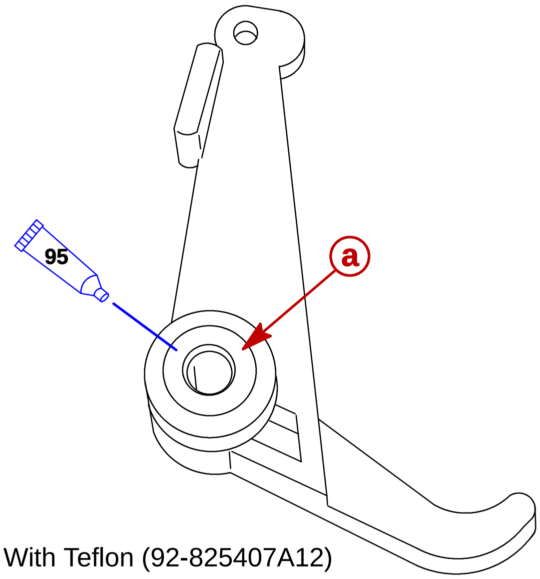


a - Throttle Cables
b - Throttle Cam
c - Bracket

Neutral Interlock Control Lever

Reassembly/Installation

1. Lubricate bushing with 2-4-C w/Teflon and install bushing.

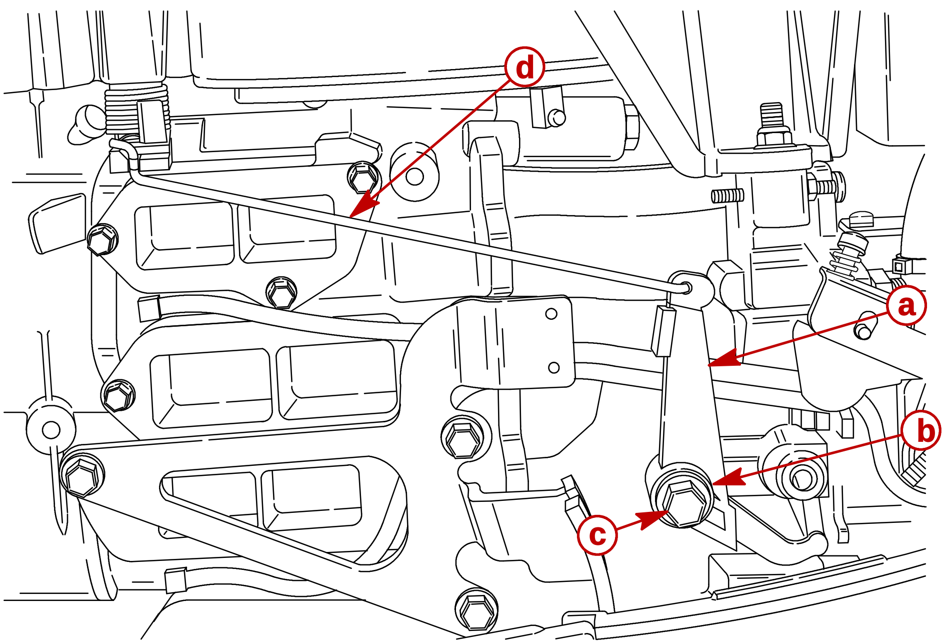


95 2-4-C With Teflon (92-825407A12)

57045

a - Bushing

2. Secure interlock lever components with bolt onto mounting boss of crankcase cover.



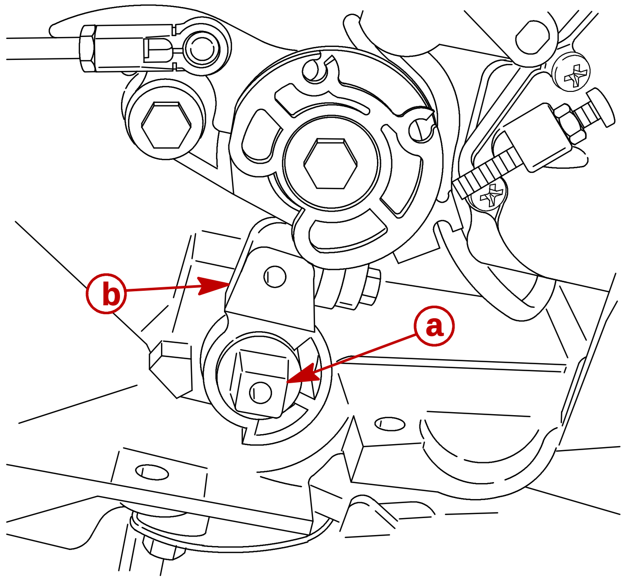
57064

a - Interlock Lever
b - Flat Washer
c - Bolt – Torque to 120 lb. in. (13.6 N·m)
d - Neutral Interlock Wire

Horizontal Shift Shaft

Reassembly/Installation

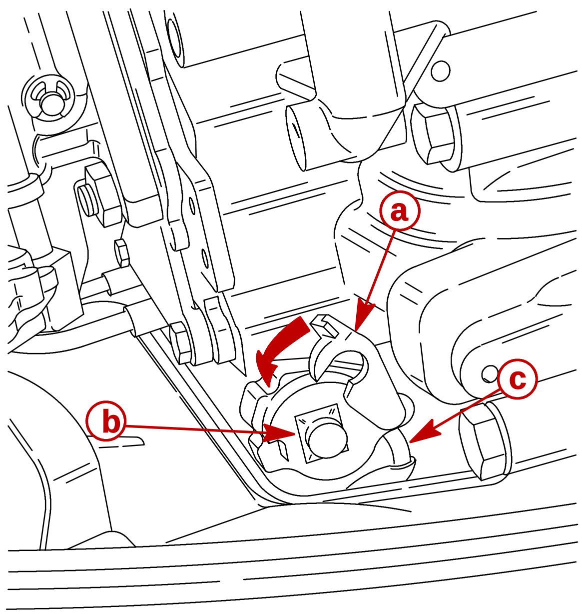
1. Install horizontal shift shaft/shift lever assembly into opening in STARBOARD side of crankcase cover.



57046

a - Horizontal Shift Shaft
b - Shift Lever

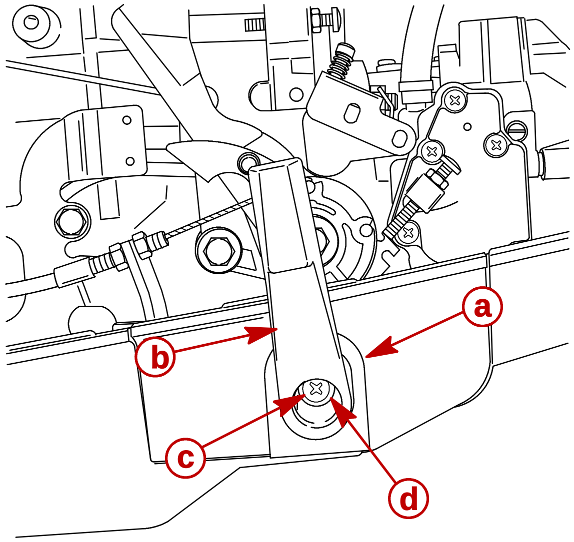
2. Secure horizontal shift shaft to shift rod with lever .



57047

a - Lever
b - Horizontal Shift Shaft
c - Shift Rod

3. Install rubber grommet into opening in starboard side of bottom cowl.
4. Secure shift handle onto end of horizontal shift shaft with screw and flat washer. Torque screw to 50 lb. in. (5.6 N·m).



a - Grommet
b - Shift Handle
c - Screw
d - Washer

OUTBOARD MOTOR INSTALLATION/ATTACHMENTS

Section 8 - Manual Starter

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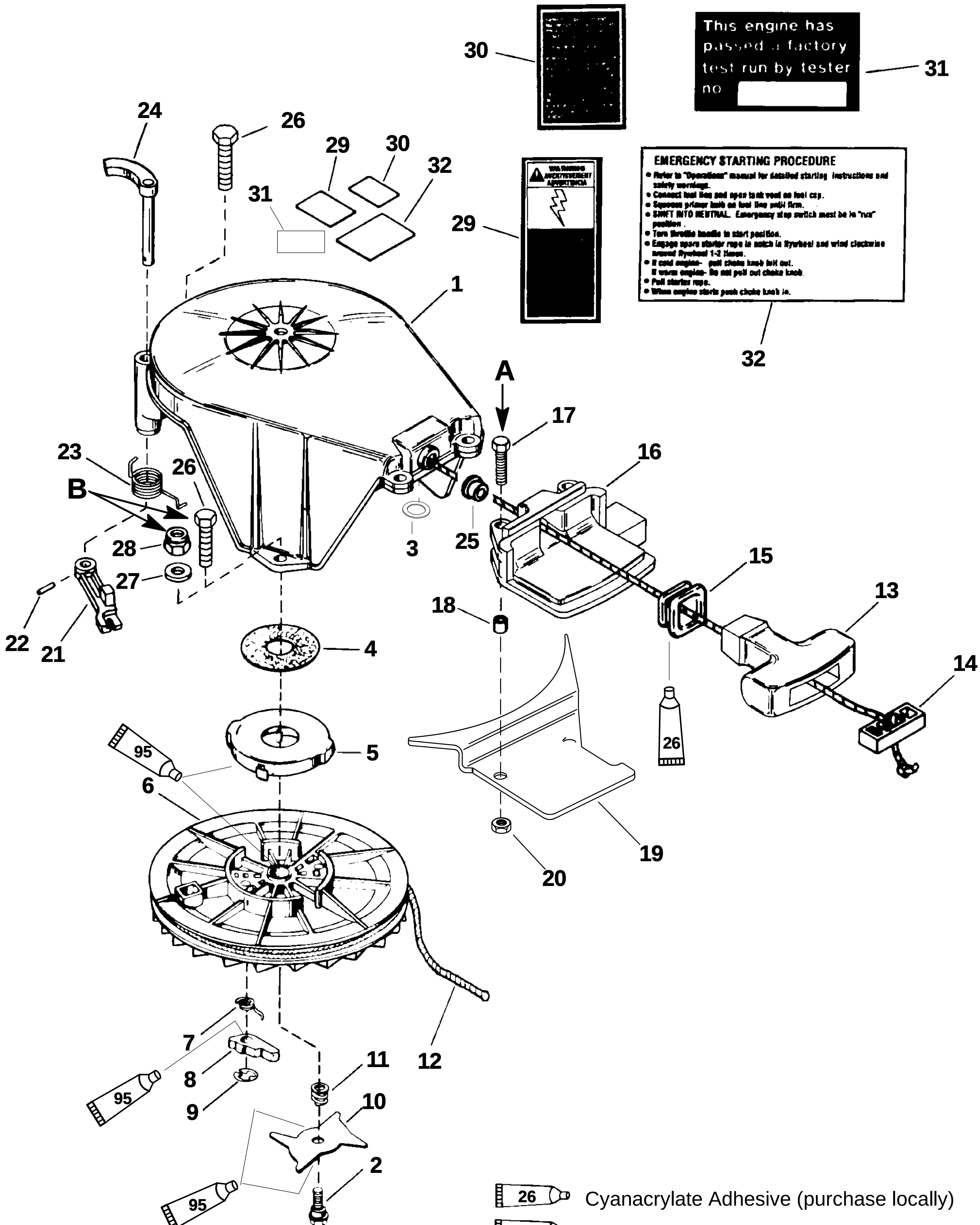
Specifications

STARTING SYSTEM	**Manual Start** **Rope Length**	Recoil 66 in. (1676 mm)

8

Starter Assembly (Manual)



26 Cyanacrylate Adhesive (purchase locally)

95 2-4-C With Teflon (92-825407A12)

A – 30 lb. in. (3.5 N·m)

B – 110 lb. in. (12.5 N·m)

Starter Assembly (Manual)

REF. NO.	QTY.	DESCRIPTION	TORQUE lb. in.	lb. ft.	N·m
–	1	RECOIL STARTER ASSEMBLY **(USA-0G/BEL- & BELOW**			
–	1	RECOIL STARTER ASSEMBLY **(USA-0G/BEL- & UP**			
1	1	HOUSING–starter **(USA-0G/BEL- & BELOW**			
	1	HOUSING–starter **(USA-0G/BEL- & UP**			
2	1	SCREW (1/4-20)	135	11.0	15.3
3	1	RETAINING RING			
4	1	PAD–felt			
5	1	SPRING–starter			
6	1	SHEAVE–starter			
7	2	SPRING–cam			
8	2	CAM			
9	2	RETAINING RING–cam			
10	1	CAM			
11	1	SPRING–cam			
12	1	ROPE–starter			
13	1	HANDLE ASSEMBLY–starter rope			
14	1	RETAINER			
15	1	BUSHING–rope			
16	1	SUPPORT–starter handle			
17	2	SCREW–support to starter housing (M5x35MM)			
18	4	SPACER–support screw			
19	1	SUPPORT			
20	2	NUT–support screw	30		3.4
21	1	LEVER–lock (LOWER)			
22	1	ROLL PIN–lock lever			
23	1	SPRING–upper lock lever			
24	1	LEVER–lock (UPPER)			
25	1	BUSHING			
26	3	SCREW **(M6 x 35) NON SEAPRO/MARATHON USA- 0G/BEL- & UP**	110		12.4
	2	SCREW **(M6 x 20)** **NON SEAPRO/MARATHON**			
	1	SCREW **(M6 x 35) USA- 0G/BEL- & BELOW**	110		12.4
27	3	WASHER (.62x.255x.03) **COMMERCIAL**			
28	3	NUT (M6 Nylon Insert) **ENGINES**	110		12.4
29	1	DECAL–high voltage			
30	1	DECAL–servicing referral			
31	1	DECAL-Caution Start in Gear **(REMOTE CONTROL)**			
32	1	DECAL–emergency start procedures			

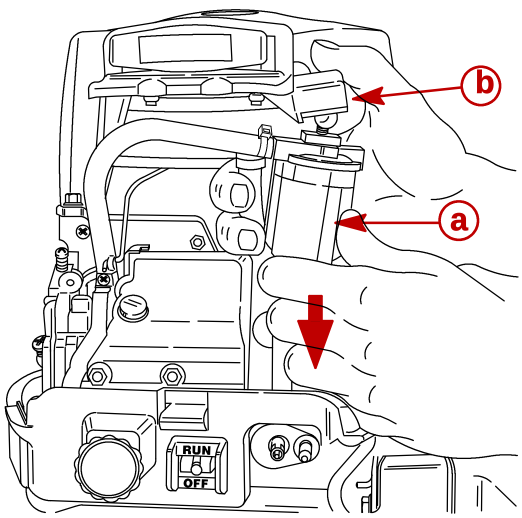
Rewind Starter Assembly

Removal

CAUTION

DO NOT turn or cock fuel filter assembly when removing. Remove fuel filter by pulling straight down. Turning or cocking fuel filter may break fuel line connection on filter.

1. Pry fuel filter from starter rope guide. DO NOT turn or cock filter; pull straight down.

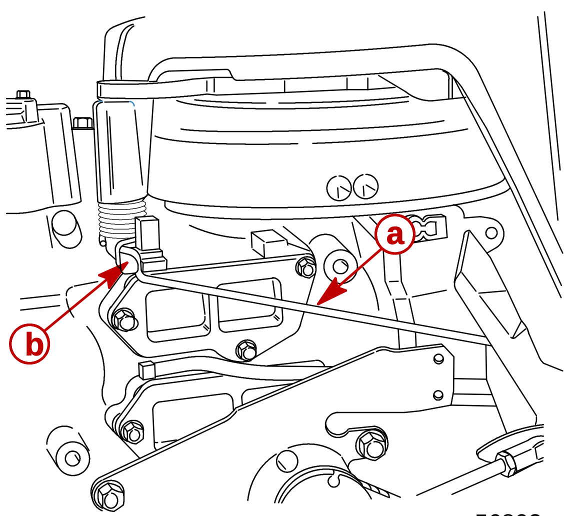


53246

a - Filter
b - Guide

56800

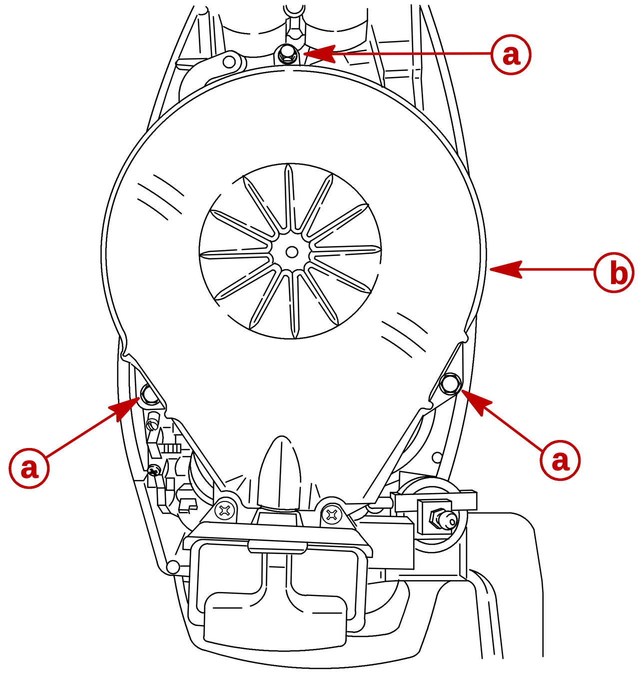
2. Unsnap interlock link rod from lower lock lever.



56803

a - Link Rod
b - Lock Lever

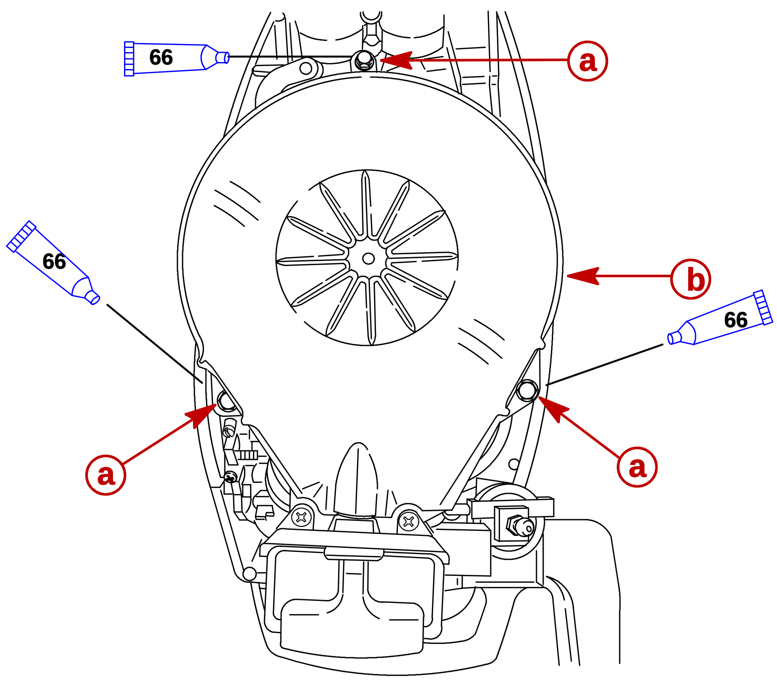
3. Remove 3 bolts and lift rewind starter from engine.



a - Bolts
b - Rewind Starter

Installation

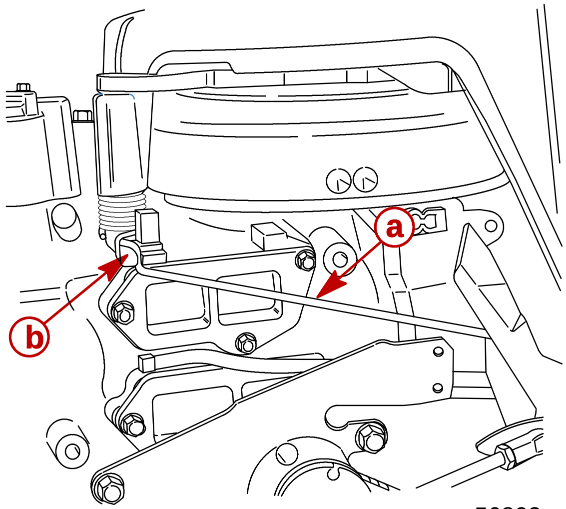
1. Secure rewind starter to engine with 3 bolts. Apply Loctite 242 to threads of 3 mounting bolts. Torque bolts to 110 lb. in. (12.4 N·m).



66 Loctite 242 (92-809821)

a - Bolts – Torque to 110 lb. in. (12.4 N·m)
b - Rewind Starter

2. Snap interlock link rod into lower lock lever.

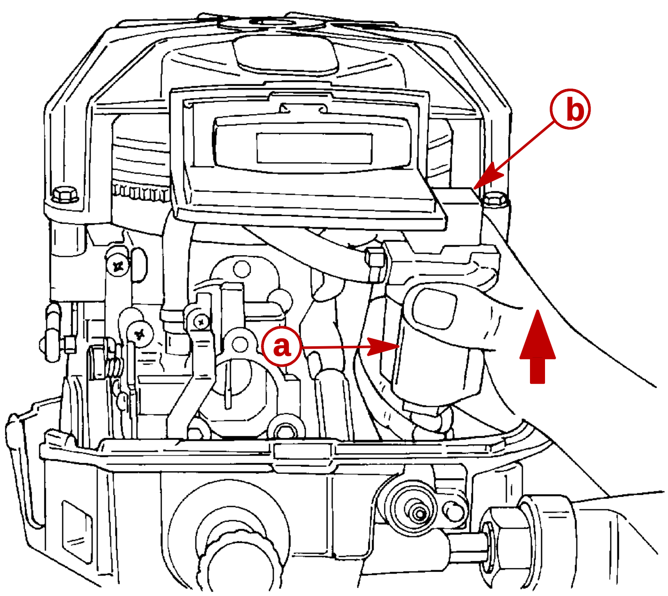


56803

a - Link Rod
b - Lock Lever

CAUTION
Push filter straight up when installing. Turning or cocking filter may break fuel line connection on filter.

3. Push ball of fuel filter into socket of rope guide. DO NOT turn or cock fuel filter.



53247

a - Filter
b - Guide

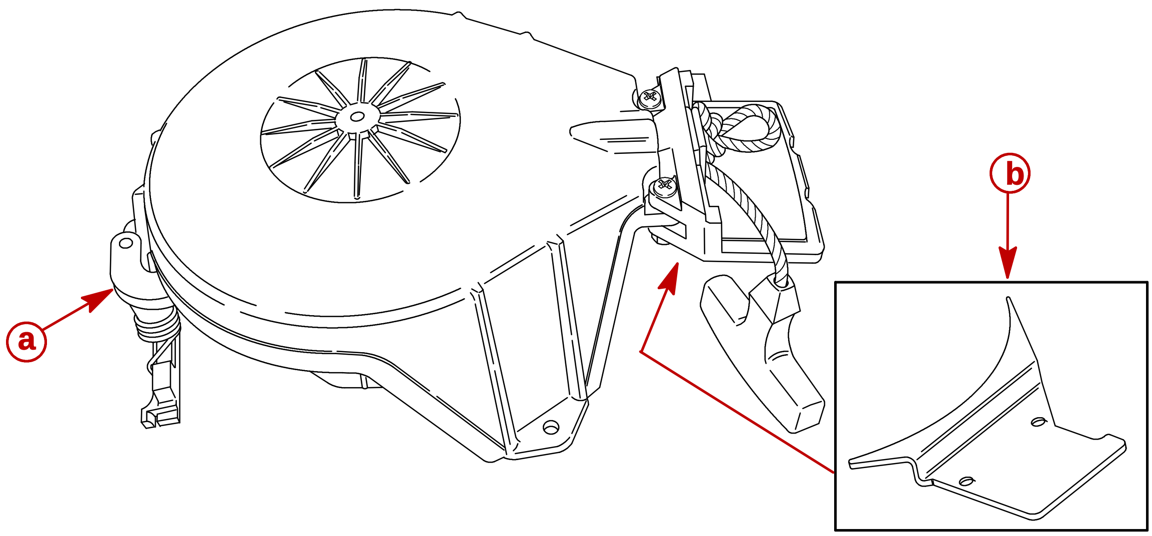
Starter Rope Replacement

1. Remove rewind starter from engine, as outlined previously.

NOTE: *If starter is broken, remove all remaining rope from sheave.*

2. Disengage starter interlock from starter sheave.
3. Pull starter rope handle out from rewind starter about 1 ft. (30.5cm) and tie a knot at this point to prevent rope from being pulled back into rewind starter.

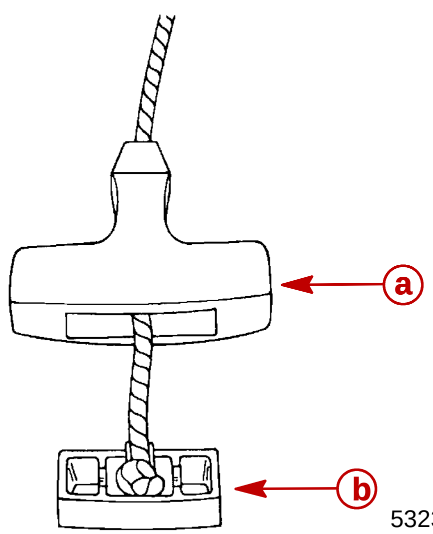
NOTE: *1999 Model and newer have a redesigned rope guide support which must be removed before replacing starter rope.*



57051

a - Interlock
b - Rope Guide Support (1999 Model and Newer)

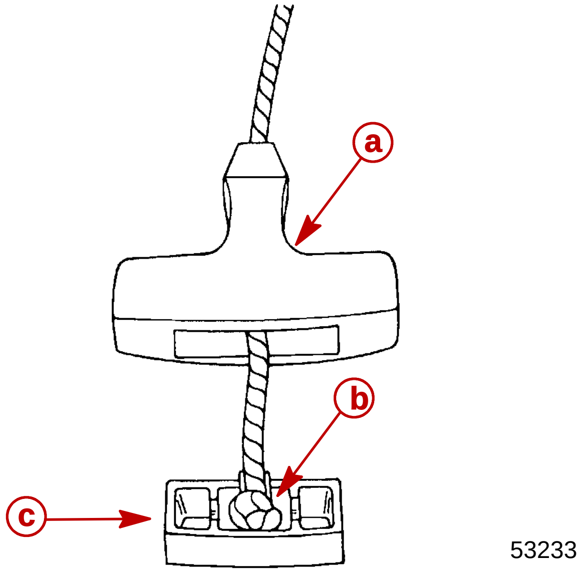
4. Remove rope retainer from starter handle and rope.



53233

a - Starter Handle
b - Retainer

5. Install starter handle on new rope cut to a length of 66 in. (1676 mm). Tie a knot into end of rope. Place knot into recess of rope retainer. Install rope retainer into starter handle.

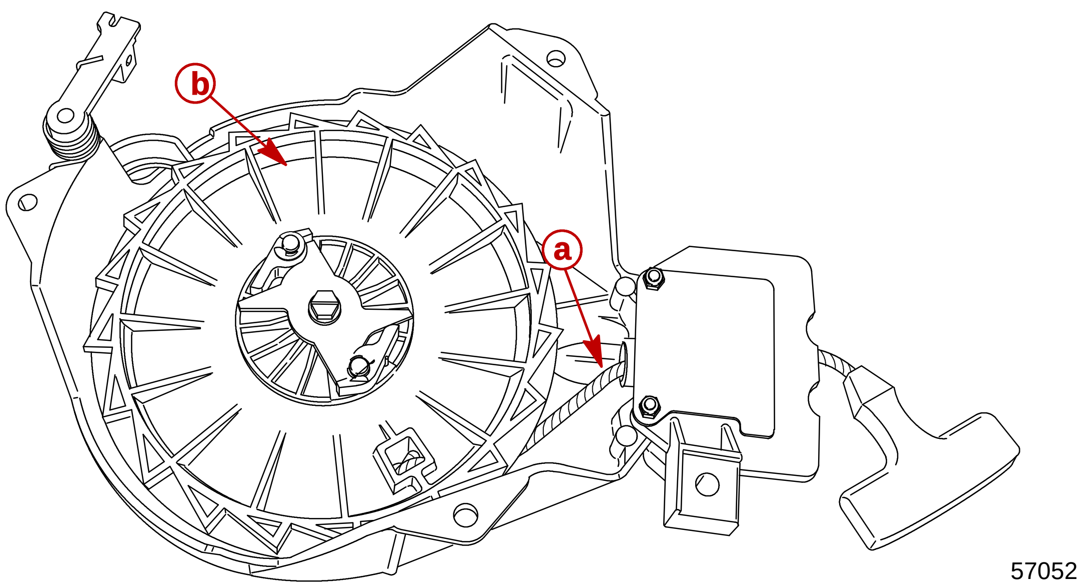


a - Handle
b - Knot
c - Retainer

⚠ CAUTION

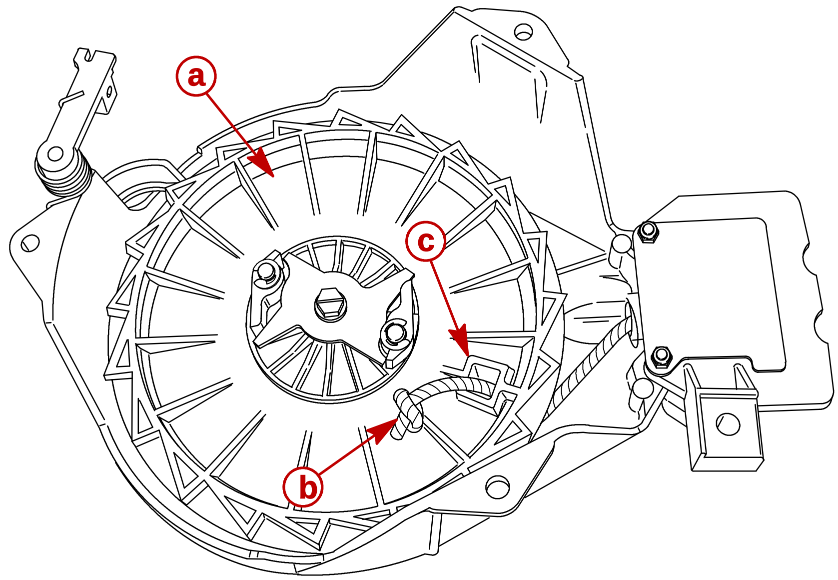
Starter sheave must be firmly held against spring tension to prevent spring from unwinding.

6. Pull starter rope from rewind starter until rope is fully unwound from starter sheave.



a - Rope
b - Sheave

7. While holding sheave in this position, lift knot from recess and pull all remaining rope from sheave.

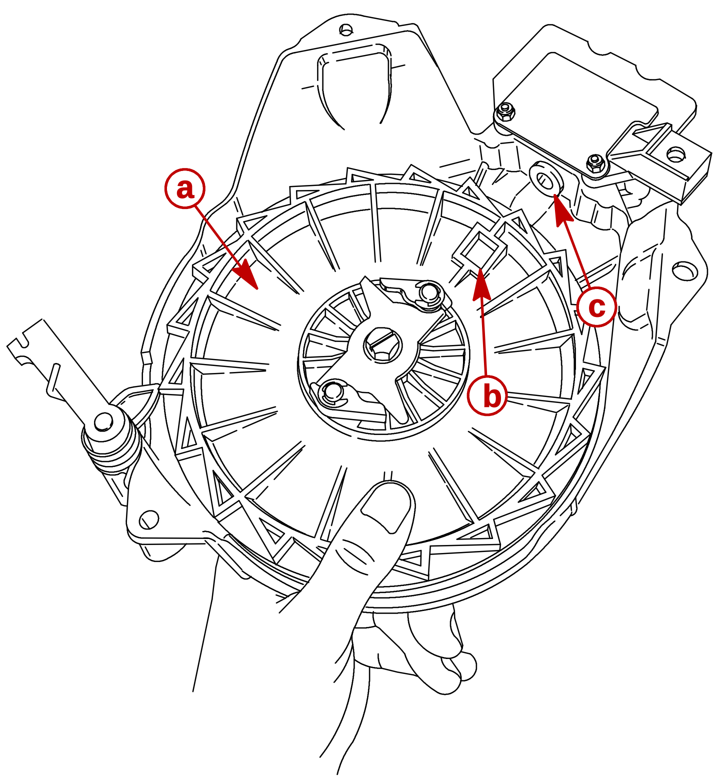


57053

a - Sheave
b - Knot
c - Recess

8. Turn sheave COUNTERCLOCKWISE until stop, indicating spring is wound tight.

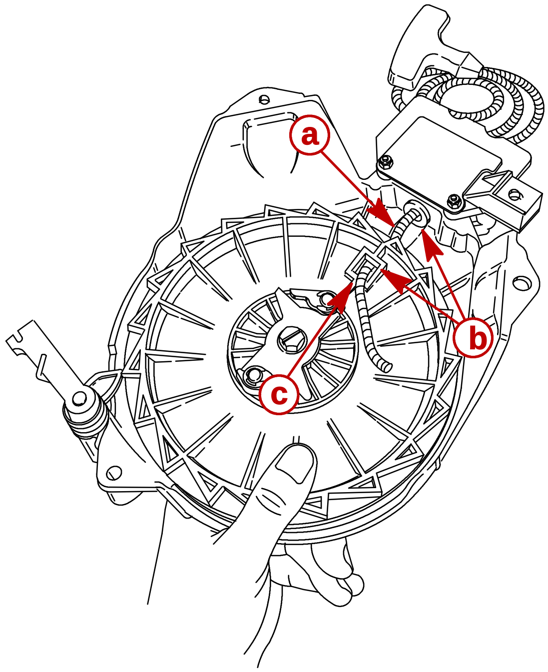
9. Slowly turn sheave CLOCKWISE (with spring tension) until knot recess is aligned with rope hole in starter housing.



57054

a - Sheave
b - Knot Recess
c - Rope Hole

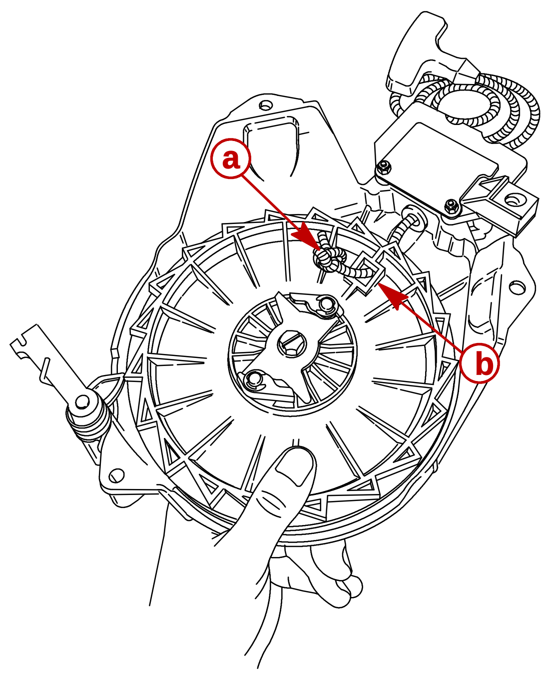
10. Push end of new rope through rope holes in starter housing and starter sheave. Pull end of rope out of knot recess.



57056

a - Rope
b - Holes
c - Knot Recess

11. Tie a knot into end of rope and pull knot back into knot recess.



57057

a - Knot
b - Knot Recess

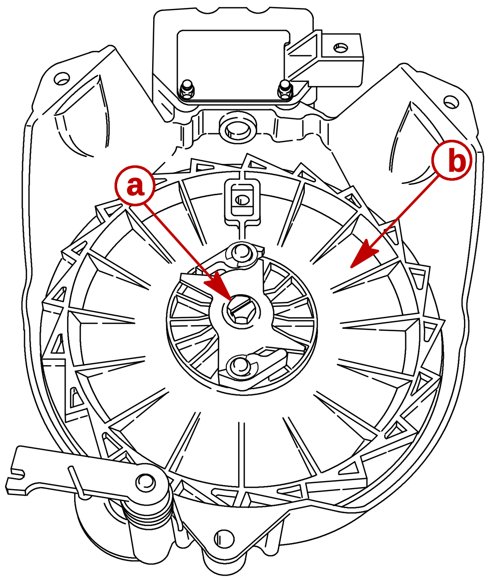
12. Allow starter rope to be slowly rewound onto starter sheave.
13. Reinstall rope guide support, if applicable.

Disassembly

⚠ WARNING

When disassembling rewind starter, SAFETY GLASSES MUST BE WORN in case spring should uncoil out of housing.

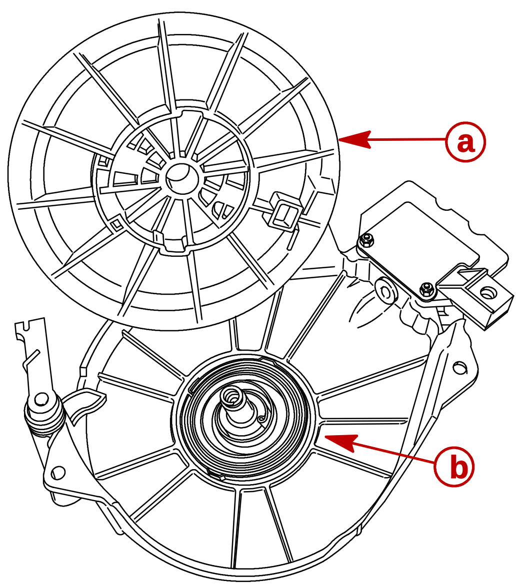
1. Remove starter rope as outlined previously.
2. With rope removed, allow sheave to slowly unwind to release spring tension.
3. Remove bolt securing cam and sheave to housing.



57055

a - Bolt
b - Sheave

4. Gently lift starter sheave from housing.
5. Rewind spring assembly may be replaced as required. DO NOT remove spring from retainer. Spring and retainer are replaced as an assembly.



57058

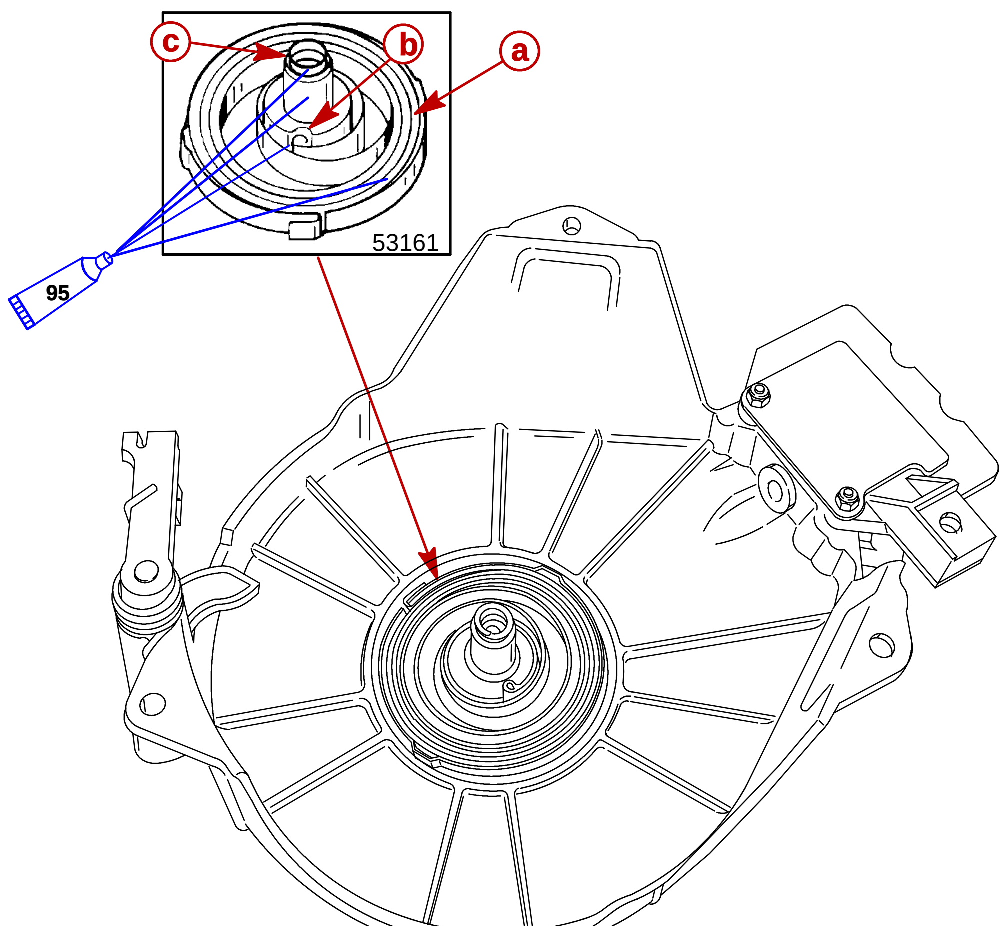
a - Sheave
b - Rewind Spring

Cleaning and Inspection

1. Clean rewind spring assembly with solvent and dry with compressed air.
2. Inspect rewind spring (without removing spring from retainer) for kinks, burrs or breakage. Replace assembly if necessary.
3. Inspect cam tension spring for damage. Replace as necessary.
4. Inspect starter sheave and housing for nicks, grooves, cracks and distortion especially in area of rope travel. Replace assembly if necessary.
5. Inspect starter rope for wear and replace if necessary.

Reassembly

1. Apply 2-4-C w/Teflon (92-825407A12) to rewind spring and cam tension spring.
2. Install rewind spring assembly into recoil housing positioning end of spring in notch.

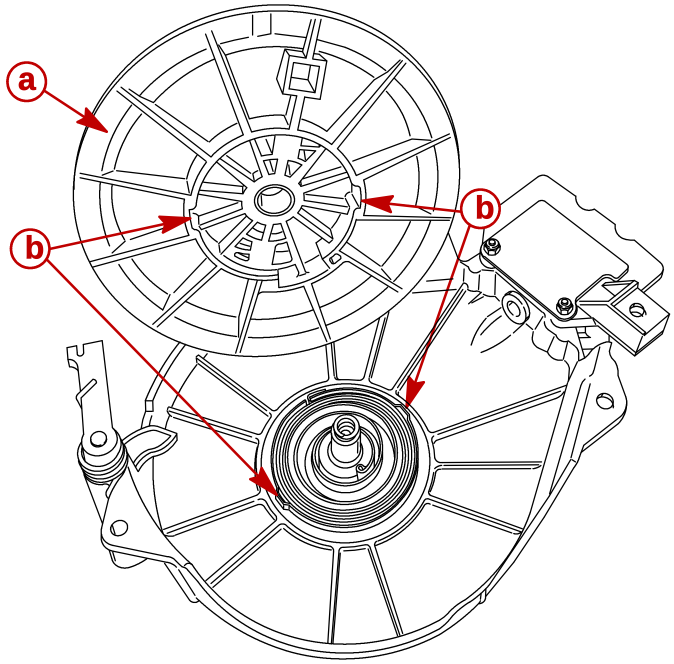


57059

95 2-4-C With Teflon (92-825407A12)

a - Rewind Spring
b - Notch
c - Cam Tension Spring

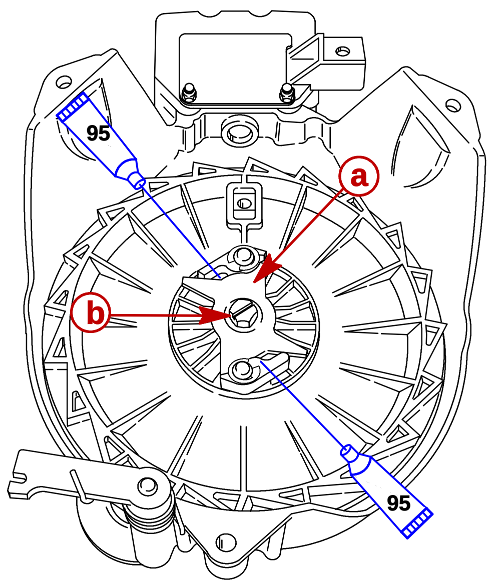
3. Install starter sheave into housing aligning notches in sheave with appropriate locations on recoil spring.



57060

a - Sheave
b - Alignment Notches

4. Secure cam to housing with bolt. Torque bolt to 70 lb. in. (7.9 N·m).



57055

95 2-4-C With Teflon (92-825407A12)

a - Cam
b - Bolt

NOTE: *If, after tightening cam retaining bolt, sheave does not move freely, sheave is not aligned properly with recoil spring retainer. Remove cam retainer bolt and check alignment of sheave with spring retainer.*

5. Apply 2-4-C w/Teflon to edge of cam that contacts both pawls.
6. Install starter rope as outlined previously.
7. Install rewind starter as outlined previously.